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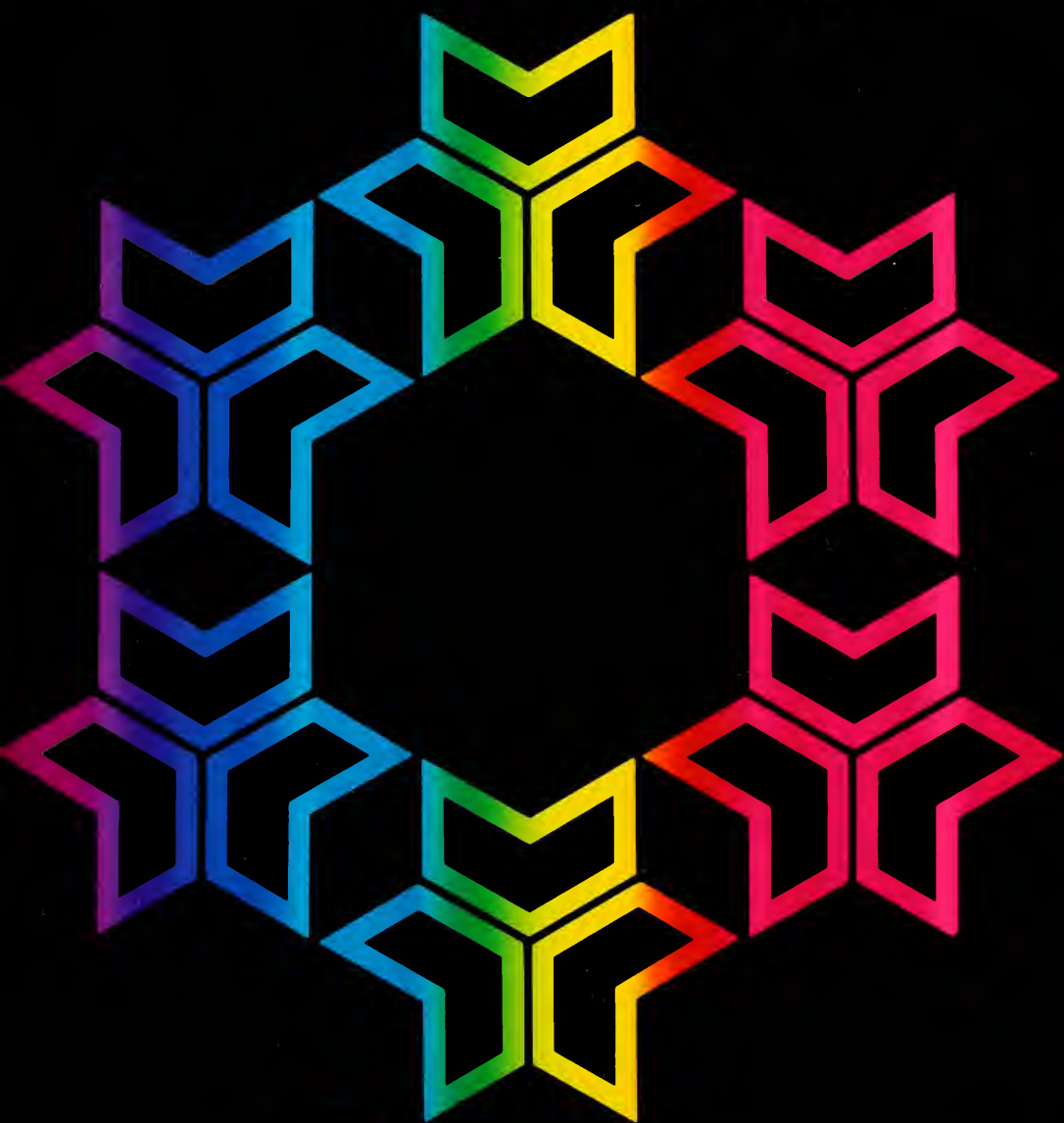
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University of
Massachusetts
Bulletin



1972
*Summer Session
at Amherst*

VOLUME LXIV

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It is the policy of the University of Massachusetts that any and all acceptance of students for admission be without regard to sex, creed, race, color, or national origin.

Summer Session 1972
University of Massachusetts at Amherst

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Summer Session 1972 Calendar

MAIN EIGHT-WEEK SESSION AND SPECIAL FRESHMAN PROGRAM

Registration day: June 26

Classes begin: June 27

Final day for adding courses: June 30

Final day for dropping courses without penalty: July 24

Classes end: August 18

DAILY SCHEDULE

Standard classes are sixty minutes in duration, and are normally scheduled to meet Monday through Friday. The standard starting times are: 7:45 a.m.; 9:00 a.m.; 10:15 a.m.; 11:30 a.m.; 1:00 p.m.; 2:15 p.m.; 3:30 p.m.

Final examinations will be given during regular class time. At the option of the instructor, two class periods may be used.

The Directory of Courses section lists the starting time

of regular course offerings and beginning and ending times of classes other than one hour long. A final schedule of courses will be available shortly before and at registration.

Special Sessions

Some departments offer certain courses and programs at dates other than the main eight-week term. These dates are given under the course descriptions and/or under the section on Special Programs.

Inquiries

Information not included in this Bulletin may be secured by writing:

Summer Session

Office of the Provost

Whitmore Administration Building

University of Massachusetts

Amherst, Mass. 01002



The University of Massachusetts

Amherst • Boston • Worcester

Founded in 1863, the University of Massachusetts is one of 66 land grant colleges and universities in the United States providing public education, research, and service. The University campus at Amherst, situated on 1,100 acres in the picturesque Connecticut River Valley, enrolls 22,500 students and is served by a \$160-million physical plant. The University has continually expanded to meet the growing needs of the Commonwealth. The University of Massachusetts at Boston opened to 1,000 freshmen in 1965 and currently enrolls approximately 4,870 students. The new University of Massachusetts Medical School at Worcester opened in the fall of 1970, and plans are presently being developed for the establishment in Amherst of a Law School.

At Amherst, a broad and continuous program is provided by the undergraduate schools and colleges, the

Graduate School, the Summer Session, and the Division of Continuing Education. Basic units are the College of Agriculture, the College of Arts and Sciences, the Schools of Business Administration, Education, Engineering, Home Economics, Nursing, and Physical Education, and the Department of Public Health. The University also has voluntary Army and Air Force ROTC programs, an active Phi Beta Kappa chapter, and more than 400 student organizations. Numerous centers and bureaus actively serve the Commonwealth in such fields as government research, labor relations, natural resources, and population.

The University has joined Smith, Amherst, Hampshire and Mount Holyoke Colleges in a five-college cooperative program, developing specific Ph.D. programs as well as operating a radio station and offering lectures, special courses, and inter-library loans.



General Information

APPLICATION PROCEDURE

Pre-registration may be accomplished by submitting application and registration forms to the Admissions Office, 255 Whitmore Administration Building, for undergraduates, and to the Graduate School, Graduate Research Center, for graduate students, prior to June 12. Course registrations and schedules will be arranged for persons applying by this date. Applications received later than this date will not be processed, but returned to the student. In such cases no scheduling will be done in advance, no bill or housing assignment will be made until Registration Day, and the student may find certain courses closed because of capacity enrollment. Course registration and scheduling will be handled on a "first-come, first-served" basis. Although every effort is made to accommodate scheduling requests, *the University cannot guarantee enrollment in a particular course section.* Early application will help to ensure a preferred schedule and will enable registration to proceed in a minimum of time.

Students whose applications have been processed must still appear on Registration Day to obtain their schedules and to sign the Certificate of Registration form. Applications for students who do not appear will be cancelled after the late registration period.

Application forms are included in this Bulletin and may also be obtained from the Registrar's Office, 213 Whitmore Administration Building, or from the Graduate School, Graduate Research Center, University of Massachusetts, Amherst, Massachusetts 01002.

Any student who holds a degree must apply through the Graduate School whether he is taking courses for credit or not, even though he is applying for undergraduate courses. Acceptance to the University Summer Session is not an acceptance to the University for any regular session (other than for "Swingshift Freshmen").

REGISTRATION

Registration for both the main eight-week session and the special Freshman Program will be held on June 26 in Boyden Gymnasium. Students may register from 9:00

a.m. to 12 noon and from 1:30 to 4:30 p.m. See also Summary of Registration Procedures just before Directory of Courses in this Bulletin.

HOUSING

It is the policy of the Board of Trustees to require the housing of undergraduates in University residence halls. Exemptions to this rule are granted to married students, to those commuting from the home of their parents, to seniors, and to those over 21 years of age.

Residence halls will open for occupancy at 1:00 p.m. on the day immediately preceding Registration Day and will close on the final day of classes. Room assignments will be available to pre-registered students upon arrival.

All rooms are provided with basic furniture, including beds and mattresses, desks, desk chairs, lounge chair, wastebaskets, bulletin boards, window drapes, and night stands. Each student is responsible for providing ash trays, pillows, bed linen, blankets, and towels. Linen service may be obtained by contract with a private linen service.

Those eligible to reside off-campus may obtain housing information by writing to the Off-Campus Housing Office, 235 Whitmore Administration Building, University of Massachusetts, Amherst, Massachusetts 01002.

BOARD

The University Food Services will offer a choice of a 10 or 15 meal ticket during the Summer Session. The charge for the 10 meal ticket (any two meals a day, Monday through Friday) will be \$16 per week, and the charge for the 15 meal ticket (three meals a day, Monday through Friday) will be \$18 per week. All students in University residence halls are required to purchase one of the two meal tickets except those students who are seniors, over 21 at the time of registration, or married. These board contracts offer a highly selective menu with a "seconds" policy on all items.

Food may be purchased on a cash basis at the Campus Center—Student Union snack bars and the snack bar located in Worcester Commons.

EXPENSES

In order to avoid delays at registration, students are encouraged to pre-register by mail before June 12 for the main eight-week term of Summer Session. This will enable the Bursar's Office to prepare a bill for each student, making it possible for the student to pay in advance. A STUDENT CANNOT REGISTER UNLESS HIS BILL IS PAID IN FULL.

As this Bulletin is prepared long in advance of the summer, the fees listed are subject to change.

TUITION for residents of

Massachusetts \$ 10 per credit

TUITION for non-residents of

Massachusetts \$ 15 per credit

HEALTH FEE* \$ 2 per week

CAMPUS CENTER FEE* \$ 2 per week

STUDENT ACTIVITIES FEE* \$ 2 per week

BOARD—

WEEKDAYS ONLY \$ 18 per five-day week

RENT** \$ 19 per week

SPECIAL FRESHMAN PROGRAM

TUITION for residents of

Massachusetts \$100

TUITION for non-residents of

Massachusetts \$300

(The matriculation fee payment of \$15 will be deducted from both tuition rates.)

HEALTH FEE* \$ 16

CAMPUS CENTER FEE* \$ 16

STUDENT ACTIVITIES FEE* \$ 16

PHYSICAL EDUCATION FEE \$ 10

BOARD—

WEEKDAYS ONLY \$144

RENT** \$152

BOOKS, STATIONERY AND SUPPLY EXPENSES

Students should be prepared to pay for necessary books and incidental supplies. Certain departments make special charges for laboratory supplies.

*Required fees, to be paid by all students including commuters.

**Depending on residence hall assignment, other rent rates are \$17 and \$22 per week.

TUITION AND FEE REFUNDS

A student who leaves the University before a term is completed will ordinarily be granted a refund of tuition and fees according to the following schedule:

- 1) During the first week of the term 60%
- 2) During the second week of the term 20%
- 3) After the second week No refund

A student who makes an advance payment and then for any reason does not attend any part of Summer Session will be given a full refund of tuition and fees after contacting the appropriate Registrar's Office.

A student involuntarily called into military service before the completion of a term will be given a pro rata refund of tuition and fees, provided that he receives no academic credit for the work of that term. If academic credit is given, there will be no refund.

A student who is suspended or expelled from the University for disciplinary reasons forfeits all rights to a refund.

No refund will be given of prepaid room rent after a term has begun and the room has been occupied.

RESIDENCE

New students who are residents of Massachusetts must file a Certificate of Residence with the Treasurer's Office in order to obtain a residential tuition rate. The application form includes the appropriate certificate.

VETERANS AND WAR ORPHANS

Students eligible for educational benefits through the Veterans Administration, either as veterans or as children of deceased or disabled veterans, should present certification of eligibility at registration. If already receiving benefits, they should enroll again for them. Students are invited to consult the Veterans' Coordinator, 239 Whitmore Administration Building, regarding their V.A. records.

MOTOR VEHICLE REGULATIONS

All student, faculty, and staff motor vehicles must be registered with the Parking Office, Room 105, Hampshire House. All students may be permitted to have a motor vehicle on campus, provided it is registered with the Parking Office and complies with published University regulations. Copies of these motor vehicle regulations should be obtained at the Parking Office.

Visitors are requested to use the new multi-level Campus Center Parking Garage unless another lot is suggested.

All areas are under roving security surveillance. Visitors may secure information at the Parking Control Booths or at the Security Building. Inquiries concerning parking should be directed to the Parking Authority, University of Massachusetts, Amherst, Massachusetts 01002.

ADMINISTRATIVE CONTACTS

The usual initial contact for students with the administrative staff is based upon a student's local residence: residence hall students should begin with their Area Coordinators; men and women commuters with the Office of Non-resident Student Affairs.

Academic Information

ADDING OR DROPPING COURSES

A student may add or drop any course during the first four class days of the term without notation on his record. No course may be added after the fourth day. After the fourth day but before the eleventh class day, a course may be dropped with a mark of W (withdrawn) recorded. After the tenth day, any course dropped is recorded as F (failing). This grade is not computed in the quality point average. The dates for the W and F designations are the same for those enrolled in the Special Freshman Program and regular Summer Session students.

OVERLOAD OF CREDITS

A full Summer Session program is usually considered to consist of three three-credit courses. Students who wish to register for additional credits must secure approval as follows:

- 1) 12 credits (one extra course)
Academic Dean (University students)
Coordinator of Summer Session (visiting students)
- 2) A senior graduating in summer or the following January may register for 12 credits without extra permission.

Forms for overloads for undergraduates may be secured in the Registrar's Office, 213 Whitmore Administration Building. Graduate students should inquire at the Graduate Office, Graduate Research Center.

AUDITING

A student who intends to audit a course must register and pay the regular tuition and activities fees. There is no special audit fee. A student who drops a course during the term, but wishes to continue on an audit basis, will receive a grade in accordance with the existing regulations governing the Add and Drop periods.



ACCELERATED ENROLLMENT

The University invites superior high school students to begin their college education immediately upon graduation by enrolling in the Summer Session. For the highly motivated student, perhaps already convinced that his formal education will require graduate or professional studies, an early start may conserve valuable time. Similarly, students in financial need may find it less expensive to complete their undergraduate education in less than four years. Summer Session attendance can substantially reduce the time necessary to obtain a bachelor's degree.

Students who wish to start their University of Massachusetts undergraduate work in the summer are advised to apply to the Admissions Office for regular admission by the fall of their senior year. At the same time, they should indicate their desire for summer study. The registrar's Office will forward a Summer Session application and detailed information regarding the summer program.

Students who have been accepted at institutions other than the University of Massachusetts may enroll in the summer program, providing they secure the approval of their college. A space for this approval is furnished on the Summer Session application.

SPECIAL FRESHMAN PROGRAM

Each year a number of high school graduates are admitted to the University with the stipulation that they begin their college careers in the Summer Session, take their vacation period during the fall semester, and join their regular class for the spring semester. After completion of this first year, students then follow the regular school year sequence.

This is an invitational program for students who apply for regular admission to the University, and it is not available to visiting students. Begun in the summer of 1964 with 180 students, the program has been expanded in recent years and will accommodate 400 students this summer, during the eight weeks between June 26 and August 18.

Students in this program normally will complete 9 credits of academic work in addition to one semester (1 credit) of required physical education. While course offerings will be limited (approximately 21 courses from 16 departments), there will be sufficient breadth to ensure most people a balanced program. In addition, a student may select one course from the numerous regular Summer Session offerings if such a choice would be in the student's best interest. Since the work completed during the summer term does not constitute the equivalent of a regular semester, students should be prepared to enroll in two courses in the fall semester in their home area to ensure that they have sufficient credits to equal a full semester.

The academic program is composed primarily of lower division courses specifically designated for students in this program. However, various courses from the regular Summer Session offerings may be elected to supplement the courses specifically designated for special freshmen. Ordinarily, a student will select three courses, including rhetoric, plus physical education. The departments offering courses in the Special Freshman Program are:

Art	Philosophy
Botany	Physical Education
Chemistry	Political Science
Engineering	Psychology
French	Rhetoric
German	Sociology
History	Spanish
Mathematics	Zoology

THESIS AND PROBLEMS CREDIT

Graduate students contemplating special course work and thesis work during the Summer Session should seek the permission of their department heads and/or advisers. Special and thesis courses are listed by number in the departmental offerings section of this Bulletin. A student who fails to register for such work will not receive an Identification Card and cannot use University facilities.

WITHDRAWALS

An undergraduate student who has attended Summer Session classes and who wishes to drop all of his courses and thus terminate enrollment must observe formal procedures. Summer Session withdrawal papers originate in the Office of Non-resident Student Affairs for commuting students, and with the Southwest Area Coordinator for on-campus residents. If a student withdraws from the Summer Session during the second half of the term (after July 22), grades of WF or WP will be entered, as appropriate, for all courses.

Summer Session withdrawal papers for graduate students may be obtained at the Graduate School, Graduate Research Center.

CREDIT FOR SUMMER WORK

All courses carry degree credit and are equivalent in method, content, and credit to courses offered at the University during the regular academic year. Credits obtained in these courses are ordinarily accepted as transfer credits by other colleges and universities.

Students who are registering for the first time or who have registered previously and desire to pursue an advanced degree at the University must secure the approval of the requisite departments and approval of the Dean of the Graduate School on the appropriate application form.

Special Academic Programs

FRENCH STUDIES AT PAU

The program in Pau, southwest France, provides study in French language, stylistics, literature and civilization. Courses are taught by French university professors, mainly from the faculties of Bordeaux and Toulouse. Open to both undergraduate and graduate students, the program permits students to enroll in courses appropriate to their language abilities and interests. Up to six University of Massachusetts credits in French can be earned. The total program is from June 17 to August 26; the study program runs from July 8 to August 22, with the extra days used for independent or group travel before and after the study program. Excursions to Lourdes, the Basque country, and other places of cultural interest are an integral part of the program. The participation fee is \$725, and covers international travel, tuition, room and board at Pau, and excursions planned as part of the program. A limited number of partial scholarships are available. Contact: French Studies at Pau, Department of French and Italian, Herter Hall, University of Massachusetts, Amherst, Massachusetts 01002.

HISPANIC STUDIES IN MADRID

In its 1972 program in Madrid, June 19 to August 25, the Department of Hispanic Languages and Literatures offers a) two graduate seminars, b) two courses open to graduates, to 1973 seniors and, by permission, to approved students of the class of 1974, and c) one undergraduate course. They are all conducted in Spanish and carry three credits each. The normal load is six credits. The purposes of the program are:

1. to provide access (for qualified students) to intensive advanced work in literature and the history of ideas;
2. to offer the experience of total immersion in the Spanish language and culture;
3. to introduce students to Spanish scholars and creative intellectuals and artists who have not come to the U.S. to teach. Among the distinguished faculty for 1972 are Pedro Lain Entralgo, Heliodoro Carpiñero, José Luis Alonso-Misol, and José Olivio Jiménez

UNIVERSITY OF MASSACHUSETTS

In addition to a six-week course of study, the program offers lectures, integrated weekend trips, and an optional post study tour of Andalucia. Basic fee includes round-trip air transportation, tuition, room and board in a selected private home (June 20 to August 4), lectures and excursions. Basic cost to Massachusetts students is \$875; to non-residents, \$905. Optional trips cost approximately \$100.

For further information write to: Director, Madrid Program, Herter Hall, University of Massachusetts, Amherst, Massachusetts 01002.

OXFORD PROGRAM

A special group of courses in English literature is regularly offered at Trinity College, Oxford, during July and part of August. The six-week session corresponds with the regular session of this University and awards University of Massachusetts credit. The courses are all taught by Oxford dons (current or past), and the Bodleian Library is available for extensive research. Graduate and undergraduate courses are offered and vary each year according to the availability of specialists at Oxford and the interests of students. Special evening lectures by noted authorities supplement these offerings. Overall cost to the student is \$875. Contact: Professor Ernest Hofer, Department of English, Bartlett Hall, University of Massachusetts, Amherst, Massachusetts 01002.

STUDY IN BOLOGNA

The University sponsors a program of summer study in Bologna, Italy, beginning in mid-June and ending the last week of August. The program is staffed primarily by members of the faculty of the University. The curriculum consists of regularly scheduled University courses on subjects in which the Italian location contributes significantly to the students' understanding and experience. These courses include Art History, History of Italy, Literature, Italian Language, and Cultural Anthropology. Field trips to major cultural centers in Italy are an integral part of the program. Any student in good academic standing at his college or university is eligible. Students will be expected to take two of any of the three-credit



courses in the fields of Art, History, Italian, Government, and Music. Cost to the student will be approximately \$875. Enrollment is limited. Contact: Professor Zina Tillona, Department of French and Italian, Herter Hall, University of Massachusetts, Amherst, Massachusetts 01002.

GERMAN STUDIES IN FREIBURG

The Department of Germanic Languages and Literature sponsors a six-week summer program, one week in Berlin and five weeks in Freiburg, Germany. Courses in elementary, intermediate, and advanced German are offered. Students may earn up to six University of Massachusetts credits. There is a three-week period for independent travel in Europe between the initial week in Berlin and the five-week study program in Freiburg. Dates of the program are June 17 to August 26.

The course fee of \$825 covers round-trip international travel, tuition, room and board, and special excursions to a number of places of cultural and historic interest, including Koln, Aachen, and the Black Forest. The program is open to both graduate and undergraduate students and is based at the University of Massachusetts Study Center in Freiburg. For further information, write to: Professor Albert Reh, Department of Germanic

Languages and Literatures, Herter Hall, University of Massachusetts, Amherst, Massachusetts 01002.

PROGRAM ABLE

Program ABLE (Accelerated Business Leadership Education), offered by the School of Business Administration, is designed to develop and enhance managerial skill among members of minority groups in our society. Persons who are presently employed in business and possess an undergraduate degree, or are graduates of accredited schools or colleges, are eligible for enrollment.

The program leads to the Master of Business Administration degree. An initial Summer Session consists of an intensive sequence of instruction in the disciplines underlying graduate business administration. Following successful completion of the summer work, students are admitted to the regular M.B.A. program of the School of Business Administration.

The entire program may be completed in 15 months—one academic year and two Summer Sessions. Financial aid is available, based on need.

For further information, write to: Dean Lawrence Johnson, School of Business Administration, University of Massachusetts, Amherst, Massachusetts 01002.

Summer Program

Each year a Summer Program is presented by the University of Massachusetts Summer Program Committee, providing the University community with a varied and balanced presentation of the arts, intramural sports, and recreational activities. Prominent musical artists and lecturers are engaged throughout the summer. Both national travelling art exhibits and exhibits of local artists are shown. A film series provides at least one film a week. The Summer Repertory Theatre presents plays of professional quality. Organized sports include softball, volleyball, tennis, and badminton. Individual participation is encouraged for swimming, outing trips, picnics, and crafts programs. All programs are coeducational.

Summer Session students are admitted free of charge to all Summer Program events upon presentation of their Summer Identification Cards. Details of the Summer Program events and ticket information will be available at registration, the Student Activities Office, and the Fine Arts Council Office.



Student Activities



The Student Activities Office in the Campus Center is the focal point for social, community, governmental, social action, cultural, and educational enrichment activity, in addition to serving as the headquarters for Recognized Student Organizations (R.S.O.) and the Program Office. It provides resource material and counsel on program planning, organizational work and group dynamics, entertainment selection and procurement, service and aid projects for campus and community, special interest activities and recreation, as well as counsel on budgeting, purchasing, and contracting. The Student Activities Office also provides a banking, bookkeeping, and auditing service for student organizations.

Participation in extracurricular activities offers opportunities to further the broader objectives of a college experience. More than 50 professional clubs on campus ex-

tend classroom interest through closer contact with members of the faculty and representatives of the professions. For those interested in communications, there are several campus publications. A wide range of social and cultural programs are coordinated through the residential colleges.

STUDENT ACTIVITIES STAFF

The following staff personnel may be contacted for any service or assistance needed:

Gerald F. Scanlon, Assistant Dean of Students, Coordinator of Student Activities; Sheila A. McRevey, Assistant Coordinator of Student Activities; James Riley, Jill W. Cochrane, and James E. Swartz, Program Advisers; Armand H. Demers, Supervisor of R.S.O. Accounts; and Lawrence Popple, R.S.O. Accountant.

Student Services

The Student Personnel Services is composed of University Offices with primary concern for students' non-academic needs, and includes:

Student Activities; Campus Center; Security; Human Services (University Health Services—physical and emotional health, Psychological Counseling, Career Planning and Placement, Community Development and Human Relations); Admissions, Records, and Financial Aid; Housing; Fraternity and Sorority Affairs; Men and Women Commuters; and Residence Area Affairs.

Dr. Robert W. Gage is Acting Vice Chancellor for Student Affairs, and Dr. William F. Field is Dean of Students.

CAMPUS CENTER

Mr. Warren T. Grinnan, Manager, Room 818, Campus Center (5-0585).

The Campus Center Manager administers and coordinates the management policies of the Campus Center Complex (which includes the Student Union Building and the new Campus Center). The duties include close coordination with the Campus Center Governing Board, serving on various committees concerned with student services, and supervision of the Campus Center Complex staff and services. Major areas of responsibility include the University Store, Campus Center Food Services, Lobby and Games Area, Campus Center Overnight Accommodations, Parking Garage, Print Shop, and Conference Operations.

FOREIGN STUDENT ADVISER

Mr. Arthur W. Boatin, 239 F Whitmore Administration Building (5-2843).

The Foreign Student Adviser offers assistance to foreign students, faculty, and staff, and should be consulted in all matters pertaining to their official immigration status while in the United States. In addition, the adviser may be consulted regarding any other problems which a person from another country encounters while at the University, such as housing, financial matters, and personal relations.

ADMISSIONS AND RECORDS

Dr. William D. Tunis, Dean of Admissions and Records, 225 Whitmore Administration Building (5-0222).

Mr. Ralph Jones, Registrar, 213 Whitmore Administration Building (5-0555).

The Admissions Office is responsible for all administrative procedures with respect to undergraduate admissions to the University including liaison with high school guidance counselors, community college staff personnel and other admissions officers for transfer students, and admissions standards set in coordination with the Provost and academic departments.

The Registrar's Office is responsible for undergraduate students at the University, administrative procedures relating to course of study, withdrawals, producing grade reports, transcripts, and maintaining the permanent academic record cards.

CAREER PLANNING AND PLACEMENT

Mr. Robert Morrissey, 239 Whitmore Administration Building (5-2225).

The Career Planning and Placement Service attempts to provide the opportunity for a candidate's individual initiative, while maintaining institutional and professional integrity without neglecting its responsibility to meet the needs of the public. The Service is made available to assist undergraduate and graduate students, as well as alumni in formulating and pursuing short and long range career objectives. The service includes personal and group counseling, assisting registrants in the planning of job campaigns, acting as an official source for references and complete credentials, providing centralized coordination for on-campus student/employer information and personal interviews, being a referral agent for interim work experience during full/part-time study, processing assistance in teacher certification application preparation, maintaining a resource library for career planning and graduate study, and offering resource personnel for in-service assistance to campus departments, individual faculty members, and student organizations.

COUNSELING CENTER

Dr. J. Alfred Southworth, Director, 243 Whitmore Administration Building (5-0333).

The basic aim of the Counseling Center is to support the student's efforts to develop into a mature, useful, self-fulfilled member of society. The Center's day-to-day work with the student-client involves psychological counseling on personal, social, educational, and vocational problems.

Consultation: Students consult with Counseling Center staff on such diverse topics as the construction of opinion polls, attitudes of staff towards campus issues, or approaches to remedying a difficult situation with parents, studies, roommates, etc. Students are encouraged to consult with the staff on any topic that would appear to be even remotely connected with the broad interests of the staff or the services offered by the Center. Many come to talk over transient adjustment problems or personal difficulties that they do not choose to share with friends, parents, or instructors. Many seek help with decision-making in vocational and educational matters. Most are dealing with problems of daily living that are a part of college life.

All individual counseling contacts with members of the Counseling Center staff are strictly confidential. No information is released to members of the University community, to parents, or to outside agencies (such as graduate schools, law enforcement agencies, or draft boards) without the student's explicit authorization, in advance.

When the need arises, the Counseling Center staff also administers and interprets psychological tests for assessing students' abilities, interests, and personalities.

Appointments: Generally, students seeking an appointment are seen immediately for an initial intake interview. An appointment is then made within a few days of the first interview.

HEALTH SERVICES

Mr. Barry Averill, Director, Health Center (5-2671).

The University Health Services has been organized to help students prevent health problems which might limit the effectiveness of their college experience. Direct services to students are supported by the Health Fee.

A staff of physicians, nurses, psychologists, pharmacists, physical therapists, technologists, and other personnel especially trained to meet student health needs are ready to provide comprehensive care in a well-equipped Health Center Infirmary. Students are encouraged to use the Health Services to obtain health care in the same way they would consult their family physician and would use the community hospital at home.

Those students who have paid the Health Fee are entitled to any care rendered on the campus by members of



the staff of the Health Services. The provision for care off campus can be arranged by the Health Services, but the cost of these services is the responsibility of the student.

Out-Patient Clinic: For a minor problem, such as a mild cold, a nurse often can offer effective treatment and save waiting time, or a student can visit the "cold self-treatment center" where medication and instructions for treating an uncomplicated respiratory infection are available.

In general, medications prescribed by the staff are provided without additional cost to students who have paid the Health Fee, except certain medications prescribed for prolonged periods. Laboratory studies, x-ray, physical therapy, and aid for emotional problems are available at the Health Center, also without additional cost.

In-Patient Clinic: The Health Center is also a hospital providing bed care for up to 65 students with serious illnesses. Usually the time lost from schoolwork is minimized if students remain on campus in the Health Center, where books and class notes are available, instead

Certificate of Domicile and Residence

Residence Requirements for Massachusetts Tuition Rates

As a state institution, University of Massachusetts offers the privilege of in-state tuition to all students entering from the Commonwealth. Eligibility for admission under the low residential rate is determined in accordance with the following policy established by the University.

1. A student must present evidence satisfactory to the Treasurer of the University that his domicile is in the Commonwealth of Massachusetts in order to be considered eligible to register in the University as a resident student. He must also have established a bona fide residence in the Commonwealth for a period of not less than one continuous year prior to the date of acceptance at the University, and certify his intention to continue to maintain such a residence.

2. The domicile and residence of a minor shall follow that of the parents unless such minor has been emancipated. In case of emancipation, the student in addition to the requirements of these regulations respecting domicile and residence shall

present satisfactory proof respecting emancipation. Minors under guardianship shall be required to present in addition to the certification of domicile and residence satisfactory documentary evidence of the appointment of the guardian.

3. No student shall be considered to have gained residence by reason of his attendance in the University nor shall a student lose residential preference during his continuous attendance at the University unless he ceases to be a citizen of the Commonwealth.

4. The domicile and residence of a wife shall follow that of the husband.

5. This form of certification for classification as to domicile and residence status must be submitted by each student. Misrepresentation of facts in order to evade the payment of out-of-state tuition shall be considered sufficient cause for suspension or permanent exclusion from the University.

6. Discretion to adjust individual cases within the spirit of these rules is lodged with the President of the University.

Note: The certificate on the reverse side is required only for new applicants to the University.

Certificate of Domicile and Residence

New applicants claiming the in-state tuition rate established for Massachusetts residents must submit this form properly completed.

Name of Student _____

Statement of Parent or Guardian:

(If student is under 21 years old)

I, _____, certify that I am the legal parent () guardian* () of _____ and that he (she) is domiciled in the Commonwealth of Massachusetts and has maintained a bona fide legal residence herein for a period of not less than one continuous year prior to the date of acceptance at the University; further, that he (she) intends to continue to maintain such a residence.

Signature _____

Statement of Student if 21 years or older:

I, _____, certify that I am 21 years or older and that I am domiciled in the Commonwealth of Massachusetts and have maintained a bona fide legal residence herein for a period of not less than one continuous year prior to the date of acceptance at the University; further, that I intend to continue to maintain such a residence.

Signature _____

*If certification is that of guardian, copy of Court appointment must be submitted.

Statement of Town or City Clerk:

This is to certify that the records of the City (Town) of _____

indicate that _____

is a legal resident of _____, Massachusetts.

Signed _____

Title _____

Date _____

(Seal)

NOTE: REGULARLY ENROLLED UNIVERSITY OF MASSACHUSETTS STUDENTS (BOTH AMHERST AND BOSTON) WHO HAVE A CERTIFICATE OF RESIDENCE ON FILE DO NOT HAVE TO SUBMIT THIS FORM.

Registration Application—Summer Session 1972—Amherst

SPECIAL NOTICE — Admission to the Summer Session in no way implies admission to a regularly scheduled semester (fall or spring) of the University.

PLEASE PRINT

Name LAST FIRST INITIAL

Home Address NUMBER STREET HOME TELEPHONE

City State Zip Code

Country of Citizenship

Summer Billing Address, if different Zip Code

EDUCATIONAL RECORD	degree	dates
Secondary School		
Colleges Attended		

CHECK AND COMPLETE ONE OF THE FOLLOWING APPROPRIATE ITEMS

- ☐ 1. Currently enrolled University of Massachusetts student Campus —
☐ Amherst ☐ Boston (complete Block 1)
☐ 2. *Formerly enrolled University of Massachusetts student Campus —
☐ Amherst ☐ Boston (complete Block 1) Date of last attendance
 *Note — Students twice dismissed from the University for academic deficiency are not eligible to attend Summer Session without approval from the Board of Admissions and Records
☐ 3. Accepted as a new University of Massachusetts student: ☐ Regular ☐ Undergraduate
☐ Graduate ☐ Accelerated Summer Freshman
☐ 4. A summer visiting student only (complete Block 2) ☐ Undergraduate ☐ *Graduate
 *A Transient Student application must also be filed.

UNDERGRADUATE FROM BOSTON CAMPUS BLOCK 1	Adviser's Signature
This certifies that the student has been enrolled at the Boston campus and has our approval to take courses listed. Record Clear: ☐ Yes; ☐ No (If No, state nature of encumbrance)	Recorder's Signature
	Date

UNDERGRADUATE FROM OTHER COLLEGES: BLOCK 2	Name of College
This certifies that the student has been enrolled at this institution and has our approval to take the courses listed	Signature
	Title
	Date

TENTATIVE PROGRAM OF COURSES

Department	Number	Title	Summer Date	Crs
Special Sessions				
Department	Number	Title	Meeting Period	Crs
Main 8 Week Term				

REGULAR UNIVERSITY STUDENTS:									
								Student Number	Class or Graduate

PLEASE CHECK APPROPRIATE BOXES:

- ☐ Undergraduate ☐ Graduate
☐ Male ☐ Female
☐ Single ☐ Married
☐ Reside in Mass ☐ Out of State
☐ Foreign ☐ Admission Male

Major Dept

Date of Birth

Sex Secretary *

RESIDENCE PLANS — CHECK ONE

- ☐ Commuting from home of parent or spouse
☐ Plan to live in Residence Hall
 Roommate choice is: _____

☐ Plan to live off-campus (see regulation — undergraduates must be 21 or seniors)

BOARD PLANS — CHECK ONE

- ☐ Plan to dine on campus
☐ Off-campus dining plans (see regulations)

For Office Use Only

No. Credits	<u> </u> S <u> </u>
Tuition	<u> </u> I <u> </u>
Rent ☐	<u> </u>
Board ☐	<u> </u>
Activities	<u> </u>
S U	<u> </u>
Health	<u> </u>
Amt. Fee	<u> </u>
Total	<u> </u>
DORM CODE	

Registration Application

Summer Session 1972

University of Massachusetts at Amherst

Completed applications should be returned as follows:

- For undergraduate work —
Registrar's Office
213 Whitmore Administration Building
University of Massachusetts
Amherst, Massachusetts 01002
(Telephone: 545-0555)
- For graduate work —
Graduate School Office
Graduate Research Center
University of Massachusetts
Amherst, Massachusetts 01002
(Telephone: 545-0721)



of going home to a hospital. Notification of parents and faculty is ordinarily the student's responsibility.

The details of medical problems are held in strict confidence and will be released to others only with the patient's permission. Parents are not notified when students visit the medical clinic or when students are admitted as in-patients unless a serious condition exists; for example, requiring major surgery.

Mental Health Division (5-2337): The medical clinic physicians may recommend that a student consult one of the Mental Health staff if it appears that a medical problem is partly the result of tension or anxiety; this is often the case with students who live under conditions of considerable stress. Students may make an appointment with one of the Mental Health staff, located in Machmer Hall. *All records are strictly confidential and will not be released without student authorization.*

Health Education Division (5-2492): The Division provides a broad range of activities aimed at helping students develop attitudes and behavioral patterns

which will promote optimal personal and community health. The staff spends considerable time in residence hall staff training programs, holds discussion-groups, and conducts a Health Services evaluation program. Programs dealing with such topics as human sexuality, mental care, and Health Services information can be arranged.

Environmental Health and Safety Division (5-2682): The Division's prime function is to coordinate efforts to assure a safe and healthful environment for students, visitors, and employees of the University. Areas of specialization are general safety, fire prevention, radiation protection, and environmental health.

FINANCIAL AID SERVICE

Lynn E. Santner, 232 Whitmore Administration Building (5-0801).

Limited amounts of scholarships, loans, and Work Study jobs are available for Summer School. This aid is available only to regularly enrolled University students. Applications for Summer Session assistance can be obtained from this office, beginning in mid-December.

Summary of Registration Procedures

PRE-REGISTRATION — SUMMER SESSION

(Students in the Special Freshman Program will be notified of acceptance and registration procedures by mail.)

1. Review and select courses from this Summer Session Bulletin.
2. Complete Summer Session registration form. (Residency, if applicable.) Graduate students are required to complete the special student application form also, if they are not already graduate students.
3. Mail form(s) to Registrar's Office (Undergraduate, 213 Whitmore Administration Building, or Graduate, Graduate School, Graduate Research Center). Deadline: June 12.
4. Pay tuition and fee bill upon mail request.
5. Confirm registration on June 26, at Boyden Gymnasium.
6. Course changes received prior to June 5 will be processed. If received later, they must be taken care of on Registration Day.
7. Housing assignments are mailed directly to pre-registered students.
8. Secure Dining Commons tickets through Dining Commons representative at Boyden Gymnasium on Registration Day; or see representative at the Central Food Service, Worcester Dining Commons, after Registration Day.
9. All tuition and fee bills must be paid before attending classes.

REGISTRATION DAY — JUNE 26

(At Boyden Gymnasium, or at Registrar's Office after this date.)

1. Review and select courses from this Summer Session Bulletin and from final Schedule of Courses available at Registration.
2. Complete application forms.
3. Have courses approved by department representatives.
4. Pay tuition and fee bills at Cashier's Office.



5. Deliver data processing cards to departments.
6. Complete housing arrangements with Housing Representative at Boyden Gymnasium on Registration Day; or at Housing Office, 235 Whitmore Administration Building, after Registration Day.
7. Complete dining arrangements, if desired, with representative at Boyden Gymnasium; or, after this date, at Worcester Dining Commons.

COURSE CHANGES

(At Boyden Gymnasium on Registration Day, or at Registrar's Office or Graduate School after Registration Day.)

1. Review and select courses from this Summer Session Bulletin and from final Schedule of Courses to be published in June.
2. Complete course add-drop form.
3. Secure departmental approval and have Registrar's Office review.
4. Pay any remaining bill at Cashier's Office.
5. Deliver data processing cards to departments.

Directory of Courses

INFORMATION FOR COURSE SELECTION — PLEASE READ CAREFULLY

The following course descriptions, in conjunction with any changes in the final Schedule of Courses to be printed just prior to Registration, include all of the information needed to select a schedule of courses.

Numbers preceding the course titles conform to the following outline:

- 000-099 Non-credit courses, non-quality point courses, entrance deficiencies
- 100-199 Undergraduate credit only—Lower Division
- 200-399 Undergraduate credit only—Upper Division
- 399 Honors Work
- 400-499 Professional courses which presume a bachelor's degree
- 500-699 Graduate credit only; courses corresponding to 200-399 series
- 700-999 Graduate level courses

Two numbers preceding a course title designate a course offered for both undergraduate and graduate credit. The student must sign for either graduate or undergraduate credit—not both.

All courses are for three credits unless otherwise indicated. In cases of specifically arranged hours, the student and instructor must agree on the number of credits to be earned. The student must indicate the desired number of credits on the application.

All undergraduate courses given under the supervision of the School of Education are graded on a Pass/Fail basis only.

Unless indicated, there are no prerequisites. Each class is 60 minutes in duration, unless otherwise specified.

Any of the following courses are subject to withdrawal if there is insufficient registration.

Inquiries concerning information not included in this Bulletin should be addressed to:

Summer Session
Office of the Provost
Whitmore Administration Building
University of Massachusetts
Amherst, Mass. 01002

ACCOUNTING

110. INTRODUCTION TO COMPUTERS FOR BUSINESS.

The BASIC and FORTRAN computer programming languages. Emphasis on use of the computer for business data processing and problem solving.

7:45 a.m.

120. INTRODUCTION TO FINANCIAL ACCOUNTING.

Introduction to principles underlying the preparation of financial statements.

10:15 a.m.

130. INTRODUCTION TO MANAGERIAL ACCOUNTING.

Continuation of 120. Emphasis on development and application of accounting data for planning and control.

10:15 a.m.

220. FINANCIAL REPORTING I.

Intensive examination of fundamental concepts underlying financial reporting. Current literature dealing with effects of alternative methods upon measurement of periodic income.

9 a.m.

221. FINANCIAL REPORTING II.

Continuation of 220 and an introduction to consolidated financial statements of affiliated companies.

10:15 a.m.

380/680. C.P.A. PROBLEMS.

Extensive practice in solution of problems for C.P.A. examinations. Topics include: proper treatment of assets, liabilities and ownership equity; partnerships; consolidations; funds and cash flow; cost accounting and management uses of accounting information; and governmental accounting.

TuTh, 7-10 p.m., July 11-Aug. 17.

385. C.P.A. PREPARATION.

Accounting practice, auditing, commercial law and theory of accounts, in preparation for certification. Areas may be elected independently.

Credit, 1-3.

Sec. 1, MW 7-10 p.m., May 29-June 16; Sec. 2, 7-10 p.m., June 26, 28, July 5, 7; Sec. 3, MW 7-10 p.m., June 12-23.

ANTHROPOLOGY AND ARCHEOLOGY

104. INTRODUCTION TO CULTURAL ANTHROPOLOGY.

Social and cultural anthropology dealing with variations among societies in technology and economics, social and political organization, art, religion, and ideology.

9 a.m.

377/677. SUMMER FIELD SCHOOL.

Practical experience and training in archeology. A colonial site will be excavated and instruction given in archeological methods and techniques. Prerequisite, Anthropology 102 or equivalent, or permission of instructor. Schedule to be arranged.

ART

100. BASIC DRAWING.

Drawing in black and white, applying pencil, crayon, charcoal techniques to representation in line and tone, emphasizing sound observation and effective presentation.

Sec. 1, 7:45-10 a.m.; Sec. 2, 10:15 a.m.-12:30 p.m.

115. INTRODUCTION TO ART.

An introduction to great works of art studied in historical sequence, including techniques and aesthetic principles.

10:15 a.m.

120. BASIC DESIGN I.

Two-dimensional design concepts arising out of work with specific problems in a variety of media. 6 studio hours.

7:45-10 a.m.

122. BASIC DESIGN II.

Continuation of Art 120. Specific 3-dimensional problems stressing the inter-relationship of materials, processes, techniques, and sculptural concepts. Prerequisite, Art 120. 6 studio hours.

2:15-4:30 p.m.

220/520. PAINTING I.

Easel painting in oil and related media, based on elementary understanding of physical properties of medium, and encouraging individual directions within limitations of sound composition. Prerequisites, Art 100, 120. 6 studio hours.

Sec. 1, 7:45-10 a.m.; Sec. 2, 2:15-4:30 p.m.

224/524. PAINTING III.

Continuation of Art 220. Prerequisite, Art 220. 6 studio hours.

7:45-10 a.m.

230/530. ADVANCED DRAWING.

Investigation and development of various techniques and media with special emphasis on figure drawing. Prerequisites, Art 100, 102. 6 studio hours.

10:15 a.m.-12:30 p.m.

295/595. AMERICAN ART.

The earliest Colonial art and architecture, the impact of later European influences, regional art of the late 19th and 20th centuries, and contemporary techniques.

1 p.m.

385, 386. SPECIAL PROBLEMS.

(also 700-705).

ASTRONOMY

100. EXPLORATION OF THE UNIVERSE.

The earth, its structure and age, the moon, the sun, other planets, and the origin of the solar system. Stars and galaxies, their birth and death. The universe, its structure and evolution. Supplemented by hours of evening observation.

9 a.m.; Lab: Tu 9-10:30 p.m.; or W 9-10:30 p.m.; or Th, 9-10:30 p.m.

BOTANY

101. GENERAL BOTANY.

An introduction to basic biological principles of organization, development and evolution, using botanical illustrations. The foundations and approach in biological research, and the consequence of this research on human thought and experience. Not open to science majors without permission of major department. 2 class hours, 1 demonstration-discussion hour.

9 a.m.

700. SPECIAL PROBLEMS.

By arrangement.

800. MASTER'S THESIS.

By arrangement.

900. DOCTORAL DISSERTATION.

By arrangement.

BUSINESS ADMINISTRATION (GRADUATE COURSES)

457. QUANTITATIVE METHODS II.

Laws and theories of probability and statistics, with applications in business and economics. Topics include probability models, sampling distribution, estimation, hypothesis testing, and decision theory.

9 a.m.

700. PROBLEMS IN BUSINESS ADMINISTRATION.

Independent study and research on selected problems in Business Administration. Permission of instructor and dean required.

Credit, 3-6 each semester. (By arrangement only.)

Sec. 1, By arrangement, Sec. 2, 7-10 p.m., Sec. 3, 7-10 p.m., June 26, 28, July 5, 7; Sec. 4, MW, 7-10 p.m., June 13-23.

722. MARKETING MANAGEMENT.

Marketing concepts of planning, organization, control and decision-making from viewpoint of business executive. Tools available for analysis and control of marketing activities are stressed.

7:45 a.m.

742. OPERATIONS MANAGEMENT.

Analysis of production problems and solution techniques applicable in industrial analysis.

1 p.m.

752. BUSINESS POLICY.

Capstone course requiring application of knowledge, theories, and techniques derived from previous courses, using integrative cases and empirical observations to formulate improved policies and plans.

9 a.m.

756. QUANTITATIVE METHODS III.

Statistical methods employed in collection, analysis, and interpretation of data. Business applications of sampling, analysis of variance, experimental design, regression analysis, and forecasting models.

7:45 a.m.

799. SEMINAR IN BUSINESS ADMINISTRATION.

The relationship of business and management to the environment in which they operate.

Sec. 1, 2:15 p.m.

808. ADVANCED TOPICS IN BUSINESS ADMINISTRATION.

A section is available in each general or functional field of study, to facilitate investigation of current literature and research effort in these areas.

Credit, 3-6.

By arrangement.

810. TUTORIAL STUDY IN BUSINESS ADMINISTRATION.

Individualized secondary or applied research in special areas of guided doctoral level investigation, permissible with consent of mentor when a suitable course in such areas is not available and the studies are related to the career-goal of the scholar.

By arrangement. *Credit, 3-6.*

CHEMICAL ENGINEERING

125. FUNDAMENTALS.

Nature and scope of chemical engineering; selected chemical processes; material and energy balances. Prerequisite, Chem. 112 or 114.

9 a.m.

126. THERMODYNAMICS.

Fundamental principles. The First and Second laws; properties of single-component systems, thermodynamic cycles, phase and chemical equilibria. Solution methods for complex energy and material balance problems. Prerequisites, Chem. 160, Math. 173, ChE. 125.

10:15 a.m.

CHEMISTRY

110. GENERAL CHEMISTRY.

Fundamental chemical laws and theories. Meets minimum prerequisite requirements of Chem. 160 and Biochem. 120 or 220. 2 class hours, 1 quiz hour, 1 2-hour laboratory period.

9 a.m.; Lab TuTh, 1-3:15 p.m.

111. GENERAL CHEMISTRY.

The fundamental chemical laws and theories, with the object of giving the student a sound scientific training through a course in chemistry. For engineers and other students planning to take advanced courses in chemistry. 2 class hours, 1 quiz hour, 1 2-hour laboratory period.

7:45 a.m.; 10:15 a.m.; 11:30 a.m.; Lab TuTh, 1-3:15 p.m. or MW, 1-3:15 p.m.

262/562. ORGANIC CHEMISTRY FOR NON-MAJORS.

Introduction to the chemistry of carbon compounds. Survey of the principal classes of organic compounds and their reactions with emphasis on the relation between structure and reactivity. Prerequisite, Chemistry 112 or 114. Concurrent enrollment in Chemistry 264/564 is required.

9 a.m.

264/564. ORGANIC LAB FOR NON-MAJORS.

Application of the experimental techniques of organic chemistry to the preparation, purification and analysis of organic compounds. Prerequisite, concurrent enrollment in Chemistry 262/562.

Credit, 1.

TuTh, 1-4:30 p.m.

CIVIL ENGINEERING

101. SURVEYING.

Theory of surveying. Use, care and maintenance of tape, transit, and level; traverse computation; topographic surveying and mapping; property surveying. Prerequisite: trigonometry. 2 class hours, 1 3-hour laboratory period.

MWF, 1 p.m.; Lab: TuTh, 1-5 p.m.

140. STATICS.

Force systems, friction, first and second moments. Prerequisite, Integral Calculus concurrently.

9 a.m.

141. STRENGTH OF MATERIALS I.

Simple and combined stresses and strains in tension, compression and shear; torsion; stresses and deflections in beams. Prerequisite, Statics.

10:15 a.m.

142. DYNAMICS.

Motions of particles and rigid bodies and the force systems associated with these motions. Prerequisite, Statics.

7:45 a.m.

257. ELEMENTARY FLUID MECHANICS.

Fundamentals of fluid mechanics including fluid properties, fluid behavior under static and dynamic conditions, and development of basic fluid flow equations. Prerequisite, Statics.

7:45 a.m.

385. SPECIAL PROBLEMS.

Individual study of a selected problem for qualified students. By arrangement with members of the department.

By arrangement.

COMPARATIVE LITERATURE

203. THE EUROPEAN NOVEL: MAN VERSUS SOCIETY.

In English translation, a number of French, Spanish, German, Russian and English novels of the 17th to 20th centuries, in the context of the consciousness they reflect, describe, and transcend.

COMPUTER SCIENCE

122/409. FORTRAN IV.

An extension of basic FORTRAN to include logical unit input/output, logical arithmetic declaratives, sub-programming techniques, systems and library routines and supervisory control cards. Prerequisite, C.S. 121 or equivalent.

10:15 a.m.

223/523. MACHINE AND ASSEMBLY LANGUAGE.

A description with substantial examples and exercises of the structure of a large-scale computer; its operating systems and languages, leading to studies of assembly and macro language capabilities.

9 a.m.

700. SPECIAL PROBLEMS.

By arrangement.

701. SPECIAL PROBLEMS.

By arrangement.

790. SEMINAR.

By arrangement.

ECONOMICS

125. ELEMENTS OF ECONOMICS.

Basic principles which govern the behavior of the American economy. Emphasis on the macroeconomic issues of full employment, price stability and economic growth.

9 a.m.

126. PROBLEMS OF THE NATIONAL ECONOMY.

Introductory analysis of resource allocation and income distribution in the American economy. Problems of international trade, underdeveloped nations, and the Soviet economy.

11:30 a.m.

201/501. INTERMEDIATE MICROECONOMIC THEORY.

Microeconomic analysis of consumers, firms, industries, and markets; rational decision making under conditions of certainty; balancing forces in a free enterprise economy.

9 a.m.

214/514. MACROECONOMIC THEORY AND BUSINESS CYCLES.

Formulation and empirical testing of static and dynamic theories of aggregative income, employment, and prices with special reference to the business cycle, growth, and economic forecasting.

1 p.m.

EDUCATION

For information about the School of Education's Summer Program, including a variety of workshops, additional In-Service Teaching Improvement Programs, and the latest course offerings, please write or call:

Dean for Academic Affairs (545-0237)

Attn.: Summer Session Information

School of Education

University of Massachusetts

Amherst, Massachusetts 01002

In-Service Teacher Improvement Programs

705. Sec. 4—SEMINAR IN EDUCATION: PRACTICAL PROBLEMS IN ARTS EDUCATION.

New methods in making use of the arts for in-service teachers. The survey and examination of arts resources for use in schools; instructional materials and techniques, aesthetic experiences in and out of the classroom, and multi-arts approaches to education. Previous training in the arts is not a prerequisite. *Credit, 6.*

10:15 a.m.-12:15 p.m.

BILINGUAL BICULTURAL EDUCATION PROGRAM—The School of Education, in conjunction with the Department of Hispanic Languages and Literatures is planning a varied and intense Summer Program in Bilingual Bicultural Education. Please write to the School of Education or the Hispanic Department for further information.

Center for the Study of Aesthetics in Education

227/527. CURRICULUM INNOVATIONS IN MUSIC AND SOUND IN EDUCATION.

A survey of methods, materials, techniques, and problems re-

lated to the innovative use of music and sound in the classroom as an aesthetic medium for enhancing learning of all kinds. Encourages development and experimental application of innovations.

11:30 a.m.

E03/686. Sec. 3. SPECIAL PROBLEMS: THE ROLE OF THEATRE ARTS IN THE CLASSROOM OF THE ELEMENTARY AND SECONDARY SCHOOL.

Survey of materials, methods, and techniques in teaching theatre arts (drama, movement, mime, oral interpretation) in public schools. Experimentation with new approaches to creative activities dealing with motivation, sense perception, and freedom of speech and movement.

TuTh, 2:15-3:45 p.m.

705. Sec. 4—SEMINAR IN EDUCATION: PRACTICAL PROBLEMS IN ARTS EDUCATION.

(See In-Service Teacher Improvement Programs, above.)

Center for Educational Research

E21/686. Sec. 21. SPECIAL PROBLEMS IN EDUCATION: INTRODUCTION TO RESEARCH FOR NON-MAJORS.

An introduction to conclusion-oriented research and critical skills in the utilization of existing research. Topics include conclusion-oriented research models; classifications of research models, threats to internal and external validity; relationship between design and analysis; basic concepts of descriptive and inferential statistics; an overview of research, development and dissemination; the utilization of existing research.

10:15 a.m.

E24/686. Sec. 24. SPECIAL PROBLEMS IN EDUCATION: COMPUTER LABORATORY WITH EDUCATION STATISTICS APPLICATIONS.

Basic skills in using the computer for the analysis of data collected during research in the social sciences. Terminal use APL, including library programs, key punch, other punched card machines. Batch processing and data management. Concurrent registration in 355/655 recommended. *Credit, 2.*

MWF, 10:15 a.m.-12 noon.

355/655. EDUCATIONAL STATISTICS I.

Measurement and notation, tabulation and percentiles, central tendency, variability, normal distribution, measures of relationships, prediction, estimation, hypothesis testing, selected inferential techniques. Concurrent registration in E24/686 recommended.

9 a.m.

833. SEMINAR ON KNOWLEDGE DIFFUSION AND UTILIZATION.

Efforts to diffuse and utilize research in agriculture, medicine, the military, the social sciences, and the world of commerce. Parallels between patterns in these fields and the field of education.

11:30 a.m.

Center for Foundations of Education

250/550. CONCEPTIONS OF LIBERAL EDUCATION.

Traditional and modern concepts of liberal education examined for relevance to contemporary liberal education.

9 a.m.

251/551. Sec. 3. **FOUNDATIONS OF EDUCATION.**

A study of selected problems and issues in modern education such as educational aims, societal expectations of the schools, church-state relations, professionalism, academic freedom, curriculum and methodological emphasis, urban education and educational innovation. Students will elect to study these problems through one of the following disciplines: educational sociology, educational history, educational philosophy, comparative education, or social psychology. They will also have the option of studying them independently or through field experience. Fulfills "Foundations" requirement for those students seeking Teacher Certification.

Sec. 1, 10:15 a.m.; Sec. 2, 9 a.m.; Sec. 3, 10:15 a.m.

Center for Higher Education

E20/686. Sec. 20. **SPECIAL PROBLEMS: AMERICAN HIGHER EDUCATION: ITS STATUS AND ITS FUTURE.**

The current status of higher education in America; developments since World War II; the future in terms of the society's and individual's needs and possible directions higher education will take.

9 a.m.

E30/686. Sec. 30. **EDUCATION, LAW, AND PUBLIC POLICY.**

This course will examine the relevance of law as a tool to maintain, restrict, or effect change in social conditions, especially as this process relates to educational institutions.

Center for Human Potential

E10/686. Sec. 10. **SPECIAL PROBLEMS: PRESCHOOLS FOR BLACK CHILDREN.**

What kinds of teachers, curricula, and classroom structures are most appropriate for Black children. How the preschool can be used to reflect and support the Black community.

TuTh, 2:15-3:45 p.m.

Center for Human Relations

E27/686. Sec. 27. **SPECIAL PROBLEMS: SEMINAR IN ELEMENTARY SCHOOL COUNSELING.**

Development of role and rationale for the elementary school counselor. Counselor's role as a change agent in the school environment. Themes and techniques for working with children.

10:15 a.m.

277/577. **PRINCIPLES OF SCHOOL GUIDANCE.**

The need for and role of the school guidance counselor. An in-depth look at an individual group organizational dimension that relates to an effective agent of social change.

TuTh, 11:30 a.m.-2 p.m.

910. **SCHOOL COUNSELING THEORIES.**

Counseling theory and research evaluation. Methodology, philosophies, ethics, problems, and issues of school counseling.

11:30 a.m.

915. **GROUP ACTIVITIES.**

A laboratory in personal and group development. T-Group sessions provide opportunity for each participant to: 1) develop a greater insight into himself, his personal value system, and his impact on others; 2) increase his sensitivity to the feelings of others and his understanding of how the behavior of others affects him; 3) examine and experience the forces that operate

in a group as well as the individual's own effectiveness in assuming roles needed to build and maintain a group; and 4) relate the small group experiences to the process of change, motivation, leadership, organization, and larger social systems. Outside reading, theory and skill sessions in class, and observation of other groups.

2 sections, by arrangement. First class meets 4:00 p.m., June 26. The classes meet continuously everyday for 7 days.

Center for Humanistic Education

222. **EDUCATION OF THE SELF.**

Each student's personal sense of identity. Exercises, techniques and procedures to provide a structured and productive experience in working with emotions and behaviors. By permission.

TuTh, 7:45-9:15 p.m.

Center for Leadership and Administration

950. **FUNDAMENTALS OF EDUCATIONAL ADMINISTRATION.**

General school administration. The relation of public education to the cultural pattern, organization and practices in school administration. A simulation of an urban high school principalship using Monroe City materials developed by UCEA.

MW 7:45-10 a.m., F, 7:45 a.m.

Center for Media

362/662. **WORKSHOP IN EDUCATIONAL TV.**

A hands-on workshop. Aims to familiarize teachers and teacher interns with hardware of television. Use of television experimentally to solve educational problems. By permission.

9 a.m.

Center for Teacher Education

E13/686. Sec. 13. **SPECIAL PROBLEMS: UNDERSTANDING THE MICRO-TEACHING CONCEPT.**

Historical perspective of the micro-teaching concept; operation of a microteaching clinic and equipment; and development of individual action programs (mini-clinics, demonstrations, etc.).

10:15 a.m.

E40/686. Sec. 40. **SPECIAL PROBLEMS IN EDUCATION: METHODS OF CLASSROOM TEACHING (ELEMENTARY).**

Students may elect modules in methods of teaching science, social studies, and math at the elementary level. *Credit, 1-3.*

E29/686. **PRINCIPLES AND METHODS OF TEACHING READING AND LANGUAGE ARTS IN THE ELEMENTARY SCHOOLS.**

Approaches to the teaching of reading and language arts in the elementary schools. Innovations in methods and materials demonstrated and discussed.

By arrangement.

264/564. **PRINCIPLES OF ELEMENTARY EDUCATION.**

The aim, organization, program and pupil population of the elementary school. Conventional practice clarified and viewed in terms of various perceived alternatives.

10:15 a.m.

285/585. **STUDENT TEACHING.**

Involves a 16-week field experience under the tutelage of a co-operating teacher and University supervisor in an approved school system. By arrangement and permission. *Credit, 1-15.*

309/609. **PRINCIPLES AND METHODS OF TEACHING
SECONDARY ENGLISH.**

An analysis of purposes, problems, issues, methods and materials in the teaching of English at the secondary level. Discussion, lectures, case studies, projects.
By arrangement.

310/610. **PRINCIPLES AND METHODS OF TEACHING
SECONDARY SOCIAL STUDIES.**

Developing a rationale for secondary school social studies instruction; selection and use of content and method in the classroom situation.
7:45 a.m.

311. **PRINCIPLES AND METHODS OF TEACHING
SECONDARY MATHEMATICS.**

The nature and content of mathematics, learning strategies, and values of self and society. Formulation of a philosophy and rationale for education in mathematics.
10:15 a.m.

312/612. **PRINCIPLES AND METHODS OF TEACHING
SECONDARY SCIENCE**

Nature and content of science, learning strategies and values of self and society. Formulation of a philosophy and rationale for education in science.
7:45 a.m.

705, Sec. 5. **SEMINAR IN EDUCATION: DEVELOPING
CURRICULUM IN THE INTEGRATED DAY
CLASSROOM.**

This seminar is designed for teachers and administrators who are committed to the Integrated Day Approach in the classroom. Participants will explore the Integrated Day through the Literature, films and discussions. Workshops will develop out of the needs of the seminar participants and will include such foci as demonstrations, organization of planning strategies, the ecology of the classroom and management skills. Participants will synthesize various areas of the curriculum into projects and learning centers for later transfer and application in their schools. Provisions will be made for developing competency in microteaching, strength training and peer supervision.

710, Sec. 1. **SEMINAR IN MATHEMATICS EDUCATION.**

A seminar focusing on recent developments in elementary mathematics education including the active learning approach, the Integrated Day Approach, and the use of physical materials and the environment.

768. **DEVELOPMENTS IN TEACHING ELEMENTARY
SCHOOL SCIENCE.**

New developments in elementary school science curriculum and teaching methodology. Recent research in the field and practical application. By permission
11:30 a.m.-1:30 p.m.

812. **NEW DEVELOPMENTS IN SECONDARY
SCHOOL ENGLISH.**

Center for Urban Education

268/568, Sec. 1. **CURRICULUM DEVELOPMENT IN
URBAN EDUCATION.**

The current curriculum, its effects on children, and its weaknesses. Development of techniques used to relate curriculum to children of alternatives to the present curriculum, and of ma-

terial relevant to urban children. A post-internship experience.
9 a.m.

313/613. **INTRODUCTION TO URBAN EDUCATION.**
Survey of urban and suburban schools; the process of learning in urban classrooms, effects of the present curriculum and various innovative techniques as they apply to urban schools.
9 a.m.

Non-Center

317/617. **INTRODUCTION TO COMPUTER
PROGRAMMING IN APL.**

Introductory exposure to APL (A Programming Language); emphasis on instructional computer applications. Lecture-discussion-workshop format supplemented with laboratory experience using the University's time-sharing computer system. For final emphasis students may elect a) advanced APL programming techniques or b) "Teaching Children Thinking"—Individual tutoring of elementary school children.
TuTh, 7:45-10:15 p.m.

E12/686, Sec. 12. **SPECIAL PROBLEMS: IMPACT OF
T.V. ON CHILDREN.**

The condition of children's T.V., both on commercial and educational television; effect of television on children; its effect as a teacher or a brainwasher; how it affects formal education; how to improve children's T.V.; how it can be used by schools to improve the quality of education.
10:15 a.m.

Credit, 1-3.

Individualized Study

385/685. **PRACTICUM IN EDUCATION.**

By arrangement.

Credit, 1-6.

391/702. **INDEPENDENT STUDY.**

By arrangement.

Credit, 1-6.

900. **DOCTORAL DISSERTATION.**

By arrangement.

Credit, 1-12.

These three courses are negotiated between professor and student. Individualized Study Contracts must be completed and filed in Room 121 of the School of Education.

Occupational Education Program

686, Sec. 18. **SPECIAL PROBLEMS: OCCUPATIONAL
EDUCATION FROM AN INTERDISCIPLINARY
PERSPECTIVE.**

Formulation of a comprehensive educational model; the function of occupational education as presently conceived; what occupational educators ought to be doing that we are not, and what we are doing that we ought not. Related concepts of psychology, ethics, philosophy, economics, avocations, alienation, poverty and racism. By permission.
1 p.m.

E19/686, Sec. 19. **SPECIAL PROBLEMS: CERTIFICA-
TION COURSE FOR ADULT BASIC EDUCATION
TEACHERS.**

Aims at certification as an Adult Basic Education Teacher. Concentrates on philosophy, psychology, and methodology of the adult student with emphasis on teacher preparation. Roughly follows the course outline as determined by the Massachusetts Department of Education Bureau of Adult Education and Extended Services.

11:30 a.m.

Reading Program

709. SEMINAR IN READING.

Individualized reading explored in light of its relevance to the Integrated Day Approach. By permission.

11:30 a.m.-1:30 p.m.

ELECTRICAL ENGINEERING

385. SPECIAL PROBLEMS.

Individual study of a selected problem for qualified students. By arrangement with members of the department.

ENGINEERING

104. INTRODUCTION TO ENGINEERING B.

The nature of engineering practice, through lectures and problem work. Some generally useful concepts to be developed in more detail in later courses. 3 2-hour lecture, problem, or laboratory periods.

10:15 a.m.

ENGLISH

125. MASTERPIECES OF WESTERN LITERATURE.

Selected masterpieces, from Homer and the Bible to James Joyce or Robert Frost. Aims to enrich the student's appreciation of literary values and develop his understanding of abiding human issues. Prerequisite, English 112 or 113.

7:45 a.m.

141. MAN AND WOMAN IN LITERATURE.

Study in literature of the relationship between man and woman. Topics might include the nature of love, the image of the hero and the heroine, definitions—past and present—of the masculine and the feminine. Readings might include works by Lawrence, Freud, Shakespeare, Cummings, Homer, the Brontës.

9 a.m.

233. SEVENTEENTH CENTURY ENGLISH LITERATURE.

Selections from the poetry and prose of the late Renaissance in England, including works by such authors as Donne, Jonson, Browne, Burton, Marvell, and Milton. Emphasis on the challenge of the new science to the traditional humanism.

2:15 p.m.

262. THE MODERN NOVEL: 1930-1960.

Analysis of some twelve novels. A continuation of English 261, but may be elected independently.

3:30 p.m.

267. CONTEMPORARY POETRY

Poetry in English since 1945.

9 a.m.

700. SPECIAL PROBLEMS.

By arrangement.

703. MIDDLE ENGLISH.

The language and documents representing the chief dialects.

10:15 a.m.

800. SEMINAR.

Topic to be announced.

By arrangement.

900. DOCTORAL DISSERTATION.

By arrangement.

ENTOMOLOGY

126. GENERAL ENTOMOLOGY.

A survey of the field; structure, development, evolution, classification, biology, and natural control of insects. Formation of an insect collection.

MWF, 9-10:15 a.m., Lab MW, 1-4:30 p.m.

FORESTRY AND WILDLIFE MANAGEMENT

225/525. THE ELEMENTS OF FOREST MENSURATION.

The measurement of trees, stands, and forest products; field-office practice in timber estimating and log scaling; collection and compilation of forest inventory data. 3 40-hour weeks.

8 a.m.-5 p.m., May 30-June 16.

FRENCH

123. INTENSIVE REVIEW OF FRENCH.

For those who are not ready for a 3rd semester of work.

130. INTERMEDIATE FRENCH: FRENCH LIFE AND CULTURE.

Intensive review and study. Readings in modern French literature. Sequence: French 130, 140. Prerequisite, French 120 or equivalent.

Sec. 1, 9 a.m.; Sec. 2, 11:30 a.m.

144. INTERMEDIATE FRENCH: FRENCH LIFE AND CULTURE.

Stresses the reading of contemporary fiction.

364/664. FOREIGN LANGUAGE RESEARCH.

Course with focus on research studies conducted in foreign language education in the past 20 years, as well as on issues and ideas germane to present language teaching practices.

9 a.m.

410. FRENCH GRADUATE READING.

Emphasizes skill in reading. It prepares students from other departments who wish to offer French in satisfaction of the "competence in a foreign language" requirement.

9 a.m.

GENERAL BUSINESS AND FINANCE

201. CORPORATION FINANCE.

Corporate financial behavior; appraisal of factors affecting decision-making regarding sources and application of funds; introduction to capital budgeting and cost of capital problem. Prerequisite, Accounting 125, or permission of instructor.

1 p.m.

260. LAW I.

Nature of law and judicial process; the concept of contract; economic functions and consequences of contracts.

10:15 a.m.

262/562. LAW III.

The nature, functions and limitations of Commercial Law. Prerequisite, G.B. 260.

9 a.m.

265/565. BUSINESS AND ITS ENVIRONMENT.

Theories and doctrines relating the firm to its environment. Aggregate legal, social, political, and economic factors in completing concepts of the role of business in society. Prerequisite, senior standing or permission of instructor. Also listed as Management 265.
1 p.m.

272. SEMINAR IN URBAN REGIONAL STUDIES.

Analysis of the dimensions of urban growth and change; discussion of the reasons behind, and the problems growing out of the economic growth and stagnation of urban areas. Prerequisite, GB 270 or permission of instructor.

GEOGRAPHY

155. INTRODUCTION TO HUMAN GEOGRAPHY.

The spatial attributes of human societies; population, cultural characteristics, settlement, and economic activity. Selected regional case studies. 2 class hours, 1 2-hour laboratory period, and field trips.
9 a.m.

GEOLOGY

101. PHYSICAL GEOLOGY.

The nature and origin of the landscape features of the earth and their underlying rocks and structures, including the work of rivers, waves, and currents, wind, and glaciers; the role of earthquakes, volcanoes, and the processes of mountain-building. 2 class hours, 1 3-hour laboratory period, and field trips.
9 a.m.; Lab, MW 1-5 p.m.

388. SPECIAL PROBLEMS FOR UNDERGRADUATES.

By arrangement.

389. FIELD PROBLEMS.

By arrangement.

700. SPECIAL PROBLEMS.

By arrangement.

800. MASTER'S THESIS.

By arrangement.

900. PH.D. THESIS.

By arrangement.

GERMAN

110. ELEMENTARY GERMAN.

Conversation, reading, grammar and composition. 2 laboratory hours by arrangement.
9 a.m.

120. ELEMENTARY GERMAN II.

Conversation, reading, grammar and composition. 3 class hours, 1 laboratory hour.
1 p.m.

130. INTERMEDIATE GERMAN I.

Reading, conversation, composition. Grammar review. Prerequisite, German 120.
9 a.m.

140. INTERMEDIATE GERMAN II.

For the non-German major who would like to develop a reading ability in German on an intensive level. Readings in modern German literature and intensive review. Prerequisite, German 130 or equivalent.

409. GRADUATE READING COURSE.

Designed for graduate students preparing for their M.A. or Ph.D. reading examination. No previous knowledge of German required.
1 p.m. *No credit.*

HISTORY

100. HISTORY OF WESTERN THOUGHT AND INSTITUTIONS.

The historical development of the western European countries, their ideas, and institutions.
11:30 a.m.

140. PROBLEMS IN EUROPEAN HISTORY 1500-1815.

The historical development of Western European thought and institutions. History majors are strongly urged to take this course before registering for advanced European courses.
9 a.m.

150. THE DEVELOPMENT OF AMERICAN CIVILIZATION TO 1876.

A survey of the American national growth.
9 a.m.

202/502. EARLY MIDDLE AGES 300-1100.

Spread of Christianity; pagan and early Christian culture; Germanic kingship; the Carolingian world; early feudalism; monasticism and ecclesiastical centralization.
10:15 a.m.

215/515. THE HISTORY OF RUSSIA II.

Political, economic, social and intellectual development of Russia. Origins of Russian Marxism and the Soviet period.
11:30 a.m.

332/632. THE SOUTH IN AMERICAN HISTORY.

From early settlement to contemporary regional problems.
11:30 a.m.

769. SEMINAR IN AMERICAN INTELLECTUAL HISTORY SINCE THE CIVIL WAR.

Training in historical research. Prerequisite, permission of instructor.
1 p.m.

INDUSTRIAL ENGINEERING

256/556. DATA PROCESSING AND INFORMATION HANDLING SYSTEMS.

Principles and applications of data processing and electronic computer systems for use by Industrial Engineers as a management tool for control and decision-making. Prerequisite, permission of instructor.
9 a.m.

271/571. BASIC PROBABILITY FOR ENGINEERS.

Probability theory including: sample spaces; discrete and continuous random variables; functions of random variables; marginal and joint probability, density and cumulative distribution functions; and moments. Prerequisite, Math. 124.
7:45 a.m.

ITALIAN

410. GRADUATE READINGS IN ITALIAN.

Emphasizes skill in reading. It prepares students from other departments who wish to offer Italian in satisfaction of the "competence in a foreign language" requirement.
10:15 a.m.

MANAGEMENT

201. PRINCIPLES OF MANAGEMENT.

Fundamental principles and practices of the managerial process in business enterprises.

11:30 a.m.

214. PERSONNEL MANAGEMENT.

Principles and policies followed by management in recruitment, development direction, and control of personnel.

10:15 a.m.

247. PRODUCTION MANAGEMENT I.

Basic principles of production management. Use of statistical, mathematical, and simulation methods in production or operations. Prerequisite, Management 201.

1 p.m.

371. BUSINESS POLICY AND STRATEGY.

An integrating course embracing all organic management functions. Cases are used as subjects for analysis and systematic decision-making practice. Prerequisite, Management 201 and senior standing.

10:15 a.m.

385. INDEPENDENT STUDY.

By arrangement.

391. SEMINAR IN ADMINISTRATION.

Advanced study and individual research in theory practice of administrative organization and behavior. Prerequisite, senior standing and permission of instructor.

11:30 a.m.

MARKETING

201. FUNDAMENTALS OF MARKETING.

The role of Marketing in our economic and social structure. The planning, the distribution, pricing and promotion of goods and services to consumer and industrial markets, viewed as internal activities of the firm, and also as they are shaped by environmental forces.

9 a.m.

210. BUYER BEHAVIOR.

Analysis of buyer motivation and buying behavior, including explanatory theories of consumer market behavior and models of the decision-making process for winning patronage. Prerequisite, Marketing 201 or permission of instructor.

11:30 a.m.

222/522. MARKETING COMMUNICATIONS.

Development of effective marketing communication strategies based upon an understanding of the characteristics of audiences.

9 a.m.

385. INDEPENDENT STUDY.

By arrangement.

MATHEMATICS

100. MATHEMATICS IN THE MODERN WORLD.

A cultural and historical presentation of some mathematical ideas to demonstrate both the scientific and the humanistic value of the subject.

7:45 a.m.

110. ELEMENTARY TECHNIQUES OF MATHEMATICS.

Some basic techniques including sets, logic, numbers, counting,

probability, functions, and graphs. A student cannot receive credit for this course and either of the courses 111 or 112.

7:45 a.m., 9 a.m.

115. ELEMENTARY LINEAR ALGEBRA.

Systems of linear equations. Vector spaces, with emphasis on Euclidean spaces. Linear transformations and matrices. Determinants, Characteristic vectors. Designed as an elective for students in School of Business Administration, Industrial Engineering, Economics. Not for credit after Math. 212.

7:45 a.m.

116. CALCULUS FOR BUSINESS AND SOCIAL SCIENCES I.

Sets, real numbers, inequalities, relations and functions, sequences, series, limits, differentiation and applications.

9 and 10:15 a.m.

117. CALCULUS FOR BUSINESS AND SOCIAL SCIENCES II.

Functions of several variables, maxima and minima, exponential and logarithmic functions, integration, introduction to differential equations. Prerequisite, Math. 116/118.

9 a.m.

130. PRECALCULUS MATHEMATICS.

Functions and graphs; analytic geometry of lines and conic sections; polynomial, exponential, logarithmic, and trigonometric functions. Primarily for students intending to study calculus but needing extensive preparation in the requisite algebra, trigonometry, and analytic geometry.

10:15 a.m.

135. CALCULUS I.

Introduction to differential and integral calculus of functions of a single variable: continuity, derivatives, extrema, curve sketching, the integral, elementary integration techniques. Primarily for students in the sciences. Credit given for only one of the courses 113, 116, 118, 122, 123, 133, 135, 153. Prerequisites, high school algebra, plane geometry, trigonometry, and analytic geometry of lines and conic sections; or Math. 130.

Sec. 1, 7:45 a.m.; Sec. 2, 9:00 a.m.; Sec. 3, 10:15 a.m.; Sec. 4, 11:30 a.m.

136. CALCULUS II.

Continuation of Math 135. Limits, partial derivatives, integration techniques, integrals as limits, improper integrals, theorems of Cauchy and Taylor, infinite series and power series, smooth curves. Credit given for only one of the courses 117, 119, 124, 125, 134, 136, 154. Prerequisite, Math. 135 or Math. 122/123 taken in 1971-1972.

Sec. 1, 10:15 a.m.

165. MULTIVARIABLE CALCULUS.

Functions of several variables, partial derivatives, multiple integrals, theorems of Green, Stokes, and Gauss. Prerequisite, Math 173/183 or Math. 136 or Math. 124/125/134 taken in Spring, 1972.

10:15 a.m.

883. DIRECTED READINGS.

By arrangement.

Statistics

121. ELEMENTARY STATISTICS.

Nature of statistics; description of data; sample distribution; statistical theories and dispersion procedures; regression and cor-

relation, time series. Not open to students who have completed Stat. 315, Psych. 241 or 245, or Soc. 247.

Sec. 1, 9 a.m.

316/616. INTRODUCTION TO THE THEORY OF STATISTICS II.

Interval estimation, hypothesis testing, analysis of variance, regression, correlation, decision theory. Prerequisite, Stat. 315.

11:30 a.m.

MECHANICAL AND AEROSPACE ENGINEERING

144. MECHANICS I (Statics).

A vector treatment of the equilibrium of particles and rigid bodies. Topics include: vector algebra, forces, moments, couples, equations of equilibrium, free-body diagrams, graphical techniques, constraints, structures and mechanisms, friction, centroids and moments of inertia, and the method of virtual work. Prerequisites, Math 124, Physics 161.

9 a.m.

145. MECHANICS II (Strength of Materials).

Notions of stress, strain, and Mohr's circle. Tension shear and torsion. Plane stress and plane strain; moments of inertia. Shear force and bending moment diagrams. Deflection of beams; indeterminate beams, Castigliano's principle; plastic bending of beams. Mechanical properties of materials. Prerequisite, MAE 144.

144.

10:15 a.m.

163. THERMODYNAMICS.

The laws of thermodynamics are introduced and applied to various energy-transforming devices. Property relations. Emphasis on the science of thermodynamics, providing a background for further study in those areas that involve thermodynamic principles. Prerequisites, Physics 162, Math 173.

10:15 a.m.

246. MECHANICS III (Dynamics).

A vector treatment of dynamics. Kinematics of a particle in two and three dimensions. Dynamics of a particle; momentum, moment of momentum, and work energy. Rigid bodies in plane motion; kinematics and dynamics. Relative motion. Prerequisite, MAE 144.

7:45 a.m.

264. THERMODYNAMICS II.

Application of the laws of thermodynamics to energy conversion devices. Introduction to irreversible thermodynamics. Prerequisite, MAE 163.

9 a.m.

265. FLUID MECHANICS. Also CE. 257.

Vector approach to the fundamentals of fluid dynamics, including the topics of fluid statics, kinematics of fluids, potential flow, vorticity, dimensional analysis. Introduction to viscous fluids and compressibility. Prerequisite, MAE 163. Required CE and MAE course.

7:45 a.m.

385. SPECIAL PROBLEMS.

Individual study of a selected problem for qualified students. By arrangement with members of the department.

Credit, 1-3.

MICROBIOLOGY

140. BIOLOGY OF MICROORGANISMS.

General considerations of the microbial world, including history, structure, growth, ecology, physiology, pathogenesis, and microbial genetics. Lectures supplemented with visual aid material.

9 a.m.

MUSIC

120. PIANO CLASS.

Piano class on electronic instruments.

11:30 a.m.

205/505. MUSIC HISTORY—MEDIEVAL AND RENAISSANCE MUSIC.

Chant and Organum through Renaissance motet and madrigal. Reading, listening, score study, analysis.

10:15 a.m.

716. ANALYSIS OF MUSIC LITERATURE. 1890. PRESENT.

Representative compositions from each period. Analysis by score and sound of the various musical forms and media. Offered on a rotation basis of period courses.

11:30 a.m.

742. RESEARCH IN MUSIC EDUCATION.

Individual research projects in selected areas of Music Education.

9 a.m.

NURSING

301. NURSING IN THE COMMUNITY.

Application of basic concepts of public health and public health nursing to the care of individuals, families and community groups. Correlated practicum provides experience in care of selected individuals, families and groups served by official and non-official public health nursing services. Enrollment limited and by permission of instructor. Students must provide transportation. June 12 to July 26.

Credit, 6.

NUTRITION AND FOOD

385/685. HUMAN NUTRITION METHODOLOGY.

Laboratory study of methods of assessing nutritional status and nutrient intake. Prerequisite: NF 352 or equivalent. June 26-July 21. 9 a.m.; Labs daily, 10 a.m.-12 noon, 1-4 p.m.

700. SPECIAL PROBLEMS.

By arrangement.

800. MASTER'S THESIS.

By arrangement.

900. DOCTORAL DISSERTATION.

By arrangement.

PHILOSOPHY

105. INTRODUCTION TO PHILOSOPHY.

An introduction to some of the most important of the general questions, ideas, theories, and methods of inquiry which have given direction to Western thought.

Sec. 1, 10:15 a.m.; Sec. 2, 1:15 p.m.

110. ETHICS.

An examination of classical and contemporary theories concerning policy formation and the justification of personal decisions and ways of life.

3:30 p.m.

125. INTRODUCTION TO LOGIC.

An inquiry into the nature of critical thinking, including the functions of language, the structure of deductive arguments, and a glimpse at inductive methods.

9 a.m.

700. SPECIAL PROBLEMS.

By arrangement.

800. MASTER'S THESIS.

By arrangement.

900. DOCTORAL DISSERTATION.

By arrangement.

PHYSICAL EDUCATION

100. PHYSICAL EDUCATION.

Skills courses in sport, dance, and other forms of physical activity available to all students in the University. *Credit, 1.*

Under P.E. 100, specific courses include:

G 01. INTERMEDIATE SWIMMING.

3:30 p.m.

G 23. MODERN DANCE I.

G 45. BOWLING I.

2:15 p.m.

G 55. GOLF I.

3:30 p.m.

G 58. HANDBALL/SQUASH.

2:15 p.m.

G 60. BEG. EQUITATION I.

Sec. 1, 10:15 a.m.; Sec. 2, 6-7:15 p.m.

G 61. BEG. EQUITATION II.

Sec. 1, 9 a.m.; Sec. 2, 7:15-8:30 p.m.

G 62. INT. EQUITATION I.

Sec. 1, 7:45 p.m.; Sec. 2, 6-7:15 p.m.

G 63. INT. EQUITATION II.

Lab Fee, \$45.; 7:15-8:30 p.m.

G 67. TENNIS I.

Sec. 1, 7:45 a.m.; Sec. 2, 9 a.m.

G 71. YOGA.

9 a.m.

PE/Educ. 285. STUDENT TEACHING.

By arrangement.

Credit varies.

370. ORGANIZATION AND ADMINISTRATION.

10:15 a.m.

662. HISTORY OF SPORT IN THE UNITED STATES.

Sport in America from earliest times to the contemporary period. Emphasis will be placed on the social, political and economic factors which affected the development of sport. Prerequisite, PE 561.

9 a.m.

700. SPECIAL PROBLEMS.

Individual research on a topic not covered by any existing courses. Normally confined to an extension of the content of an

existing course rather than an introduction to a new area of study.

By arrangement.

Credits, 3-9.

772. ATHLETICS: A PHILOSOPHIC INQUIRY.

10:15 a.m.

800. MASTER'S THESIS.

By arrangement.

Credit, 3-9.

Courses in Exercise Science:

352/652. PHYSICAL ACTIVITY AND THE MENTALLY RETARDED.

Examining the motor domain of the trainable and the profoundly mentally retarded child, and to attempt an understanding of the neurophysiological factors underlying some of today's treatment programs. Prerequisite, PE 259 and permission of instructor.

9 a.m.

700. SPECIAL PROBLEMS.

By arrangement.

813. MEASUREMENT THEORY AND HUMAN MOVEMENT RESEARCH.

The theory of the construction of evaluative instruments in human movement with emphasis on a critical examination of existing measurement devices. Prerequisites, PE 274 and 712.

10:15 a.m.

823. EXPERIMENTAL EXERCISE PHYSIOLOGY.

7:45 a.m.

843. NEUROMUSCULAR FATIGUE.

Analysis of fatigue and recovery processes in gross human motor activity. Prerequisites, PE 621, 742, 813, and Stat 551 and 561.

1 p.m.

800. MASTER'S THESIS.

By arrangement.

Credit varies.

900. DOCTORAL DISSERTATION.

By arrangement.

Credit varies.

PHYSICS

141. INTRODUCTORY PHYSICS I.

Mechanics, sound, heat; electricity, magnetism, light and modern physics, using trigonometry and algebra, but not calculus. Intended for pre-medical, pre-dental, pre-veterinary and some science major students. Prerequisites, Math. 121 previously or concurrently.

9 a.m.; Lab MTuW, 10:15 a.m.

Credit, 4.

163. GENERAL PHYSICS III.

Electromagnetic radiation, optics, atomic and nuclear physics. Prerequisites, Math. 136; Physics 162.

9 a.m.; Lab MTuW, 10:15 a.m.

Credit, 4.

POLITICAL SCIENCE

100. AMERICAN POLITICS.

Introduction to constitutional principles and public policy making in American national government. Democratic theory, major national political institutions, electoral behavior, and selected public policy questions.

2:15 p.m.

150. COMPARATIVE POLITICS.

Introduction to political structures, processes, and comparative national development in parliamentary, one-party, and other political systems. The relationship of cultural values to institutions; emphasis on such forces of change as democracy, industrialization, and revolution.

10:15 a.m.

202/502. MODERN POLITICAL THOUGHT.

The development of political thought and its relation to cultural and institutional growth from the rise of the modern state to the present.

2:15 p.m.

240/540. GOVERNMENT AND POLITICS OF SOUTH AMERICA.

A comparative analysis of the interest groups, political parties, and governmental institutions of the South American countries. Emphasis on the background and political culture in which Latin American politics take place.

11:30 a.m.

321/621. THE PRESIDENCY IN AMERICAN GOVERNMENT.

Constitutional and political aspects of the Presidency in legislation, administration, and conduct of foreign and military affairs. The President as party leader. Prerequisite, Pol. Sci. 100 or 160-161.

PSYCHOLOGY

101. ELEMENTARY PSYCHOLOGY.

The basic approaches and concepts of modern psychology. Examples of perception, conditioning, cognitive processes, social behavior, tests and measurements, and personality. The heuristic value of these concepts and approaches in considering some of the problems of society.

11:30 a.m.

141. PSYCHOLOGICAL METHODS.

Introduction to the ways questions about behavior are formulated and then tested through experiments. Lectures and laboratory experiences involving concepts from many areas of psychology are used to expose psychology majors to the procedures utilized in designing, conducting, and reporting experiments. Prerequisite, Psych. 101.

9 a.m.; Lab by arrangement.

145. STATISTICS IN PSYCHOLOGY.

Introduction to statistical principles and techniques as applied to psychological data.

10:15 a.m.

230. MOTIVATION.

Introduction to theories and research on the nature and determinants of motivation. Topics include instinct, behavior and energization concepts, biological and acquired bases of emotions and motives, frustration, conflict and stress. Prerequisite, Psych. 101.

9 a.m.

262. CHILD PSYCHOLOGY.

Psychological development of the child, including language, emotions, intelligence, social behavior, motivation, and personality. Not open to psychology majors. Prerequisite, Psych. 101.

7:45 a.m.

263. PSYCHOLOGY OF ADOLESCENCE.

Consideration of the development, and emotional, social and intellectual adjustment of the individual during the adolescent years. Prerequisite, Psych. 101.

9 a.m.

301. EDUCATIONAL PSYCHOLOGY.

Psychological facts and principles of development, learning, and measurement as applied to educational situations. Prerequisite, Psych. 101.

11:30 a.m.

305. HISTORICAL AND CONTEMPORARY SYSTEMS.

General structure of psychological theory; analysis and comparison of historical systems in the tradition of British empiricism-associationism and Continental rationalism, and of derivative near-contemporary and contemporary mentalistic, functionalistic, and behavioristic systems. Prerequisite, Psych. 101.

7:45 a.m.

871-872. CLINICAL PRACTICUM.

By arrangement.

Credit, 3-12.

PUBLIC HEALTH

123. DYNAMICS OF PERSONAL AND COMMUNITY HEALTH.

Development of understanding and attitudes relative to personal, family and community health needs. Attention given to mental and physical well being, drugs, sexuality, communicable and chronic diseases and health services.

11:30 a.m.

304/604. SCHOOL HEALTH.

Consideration of the principles, concepts, methods, and dynamics of the organization of a school health program at the elementary and secondary level. Stress is placed in the planning and teaching in problem areas, (i.e., sex education, mental health and drugs). Prerequisite, junior or senior standing or permission of instructor.

10:15 a.m.

375/675. PUBLIC HEALTH STATISTICS.

Principles of statistics applied to the evaluation of public health practices.

9 a.m.

385. SPECIAL PROBLEMS.

Individual study of a selected problem for qualified students. By arrangement.

Credit, 1-3.

700. SPECIAL PROBLEMS IN PUBLIC HEALTH.

Special investigational or research problems in public health for advanced students. The scope of the work can be varied to meet specific conditions.

By arrangement.

Credit, 3-6.

782. SUPERVISED FIELD TRAINING (Internship).

For students majoring in public health. Supervised field observation and professional experience in selected public health agencies. Assignments in either associate functions or internship. Departmental staff; consultants in public health agencies. By arrangement.

Credit, 6-12.

800. MASTER'S THESIS.

By arrangement.

Credit, 3-10.

RHETORIC

100. LANGUAGE & WRITING.

How we choose words and styles to express ourselves and our world. Particular attention to the written language. Varied opportunities for written expression, on different subjects, for different purposes and audiences. Short reading assignments, some about language, and frequent short papers. Emphasis on responsible choice in the language we use in both our academic and everyday lives.

Sec. 1, 10:15 a.m.; Sec. 2, 11:30 a.m.; Sec. 3, 1 p.m.; Sec. 4, 2:15 p.m.; Sec. 5, 7:45 a.m.; Sec. 6, 7:45 a.m.; Sec. 7, 9 a.m.; Sec. 8, 10:15 a.m.

110. LANGUAGE AND SPEAKING.

Choosing and managing materials and ideas in speaking situations. Interplay of communication, spoken language, and personal development.

Sec. 1, 9 a.m.; Sec. 2, 10:15 a.m.; Sec. 3, 10:15 a.m.; Sec. 4, 11:30 a.m.; Sec. 5, 1 p.m.

140. VOICES OF IMAGINATIVE WRITING.

Examination of various kinds of verbal imaginative expression in our culture—rock lyrics and modern poems, advertising, short fiction, drama—with a view to helping students become more articulate and critical as readers and more resourceful and daring as writers. Exercises in critical reading or analysis balanced by frequent "creative" writing activities in various genres. By "playing" with language in various ways, the student is led to serious efforts at self-expression and self-definition.

Sec. 1, 11:30 a.m.; Sec. 2, 1 p.m.

145. CRITICISM AND THE THEATRICAL ARTS.

The roles and styles of the critic, using as subject matter the theatrical area (theatre, dance, and film)

SLAVIC LANGUAGES AND LITERATURES

257/557. SOVIET LITERATURE.

SOCIOLOGY

101. INTRODUCTION TO SOCIOLOGY.

The fundamental terminology of sociology and intensive discussion of selected topics from a sociological point of view.

Sec. 1, 7:45 a.m.; Sec. 2, 1:00 p.m.

231. SOCIOLOGY OF AGING.

Aging as a social phenomenon in the United States and Massachusetts with emphasis on the elderly population. Topics include biological, psychological, and social factors in the aging process, the demographic and ecological conditions of aging, the problem of retirement, and public policy and politics as they relate to old age.

9 a.m.

251. URBAN SOCIOLOGY.

A comparative analysis of cities and of urbanization with special reference to demographic characteristics or urban populations, urban ecology, and urban social structure. Prerequisite, Soc. 101.

10:15 a.m.

256. RACE RELATIONS.

The social, economic and political aspects of racial and ethnic

problems in the United States, plus briefer considerations of similar problems in Africa and Asia. Prerequisite, Soc. 101.

11:30 a.m.

278. CRIMINOLOGY.

The nature of crimes and the factors underlying criminal behavior. The machinery of justice; the law, courts, police systems, and correctional institutions.

10:15 a.m.

SPANISH

110,120. ELEMENTARY SPANISH.

For students with no previous creditable training in Spanish. Intensive practice in language skills. To fulfill the language requirement, upon completion of the course most students are required to continue by taking Spanish 130 or 140.

7:45 a.m.

126. ELEMENTARY SPANISH—INTENSIVE.

An intensive elementary course with emphasis on the oral aspect designed to allow completion of Spanish 110 and 120 in one course. Open to all.

9 and 11:30 a.m.

Credit, 6.

130,140. INTERMEDIATE SPANISH.

For upperclassmen who have completed Spanish 110-120, and those freshmen and transfer students who are found qualified by placement examination. Training in language skill, with emphasis on speaking and understanding; readings in cultural and literary texts. Students completing Spanish 140 fulfill the language requirement.

10:15 a.m.

181. ORAL SPANISH.

Oral aspects of the language: pronunciation, vocabulary building, speeches, discussions, debates. Grammatical elements required for correct and fluent use of American and Peninsular Spanish. Prerequisite, Spanish 140 or permission of the department.

9 a.m.

The following courses are tentatively offered as part of the Bilingual-Bicultural Institute being planned in collaboration with the School of Education. Please check registration day for the final course numbers and titles.

3--/6--. ENGLISH AS A SECOND LANGUAGE FOR SPANISH SPEAKERS.

3--/6--. CARIBBEAN LITERATURE.

3--/6--. LANGUAGE AND CULTURE OF SPANISH SPEAKING MINORITY GROUPS.

3--/6--. CULTURAL AND HUMANISTIC AWARENESS.

700. PROBLEM COURSE.

Directed study in some phase of linguistics or literature.

By arrangement.

SPEECH

115. INTRODUCTION TO THEATRE.

A survey of the theatre: its aesthetics, elements, forms, and contributing artists; its influences and place in our culture.

9 a.m.

182. INTRODUCTION TO COMMUNICATION DISORDERS.

The types and causes of communication disorders; emphasis on speech disorders.

7:45 a.m.

225/525. HISTORY AND DEVELOPMENT OF MOTION PICTURE.

Evolution of the motion picture as an international art form and social force. Analysis of form, technique and impact of film. Selected screening of representative film styles and content.

MTuW, 1 p.m., Th, 1-3:15 p.m.

288/588. CLINICAL PRACTICE.

Supervised experience in therapy with individuals having articulatory type disorders. May be repeated once. Prerequisites, Speech 181 and 182.

By arrangement.

Credit, 1-3.

289/589. COMMUNICATION PROBLEMS OF DEAF & HARD OF HEARING.

The physical, psychological, social, and educational problems and needs of the hearing handicapped. Prerequisite, Speech 250/550.

TuTh, 9-11:15 a.m.

390/690, Sec. 1. SEMINAR IN COMMUNICATIONS DISORDERS.

Behavior modification in Communication Disorders. The habilitation and rehabilitation of speech and language disorders through behavior modification using operant procedures. Prerequisites, Speech 182 and 283/583.

MW, 9-11:15 a.m.

391/691. SEMINAR IN MASS COMMUNICATION.

The media and social reform. Historical and contemporary efforts of mass media in promoting social reform in this country and in reflecting and generating awareness of social reform movements. The independent and combined activities of books, newspapers, film, radio, and television. Judgments of varying degrees of effectiveness of the media.

TuTh, 7-9:30 p.m.

ZOOLOGY

101. INTRODUCTORY ZOOLOGY.

Principles of zoology including cell structure and metabolism, heredity, development, behavior, evolution, ecology, and the anatomy and physiology of the major groups in the animal kingdom. Provides background for understanding current biological problems.

MWF, 9 a.m., Lab TuTh, 1-4 p.m.

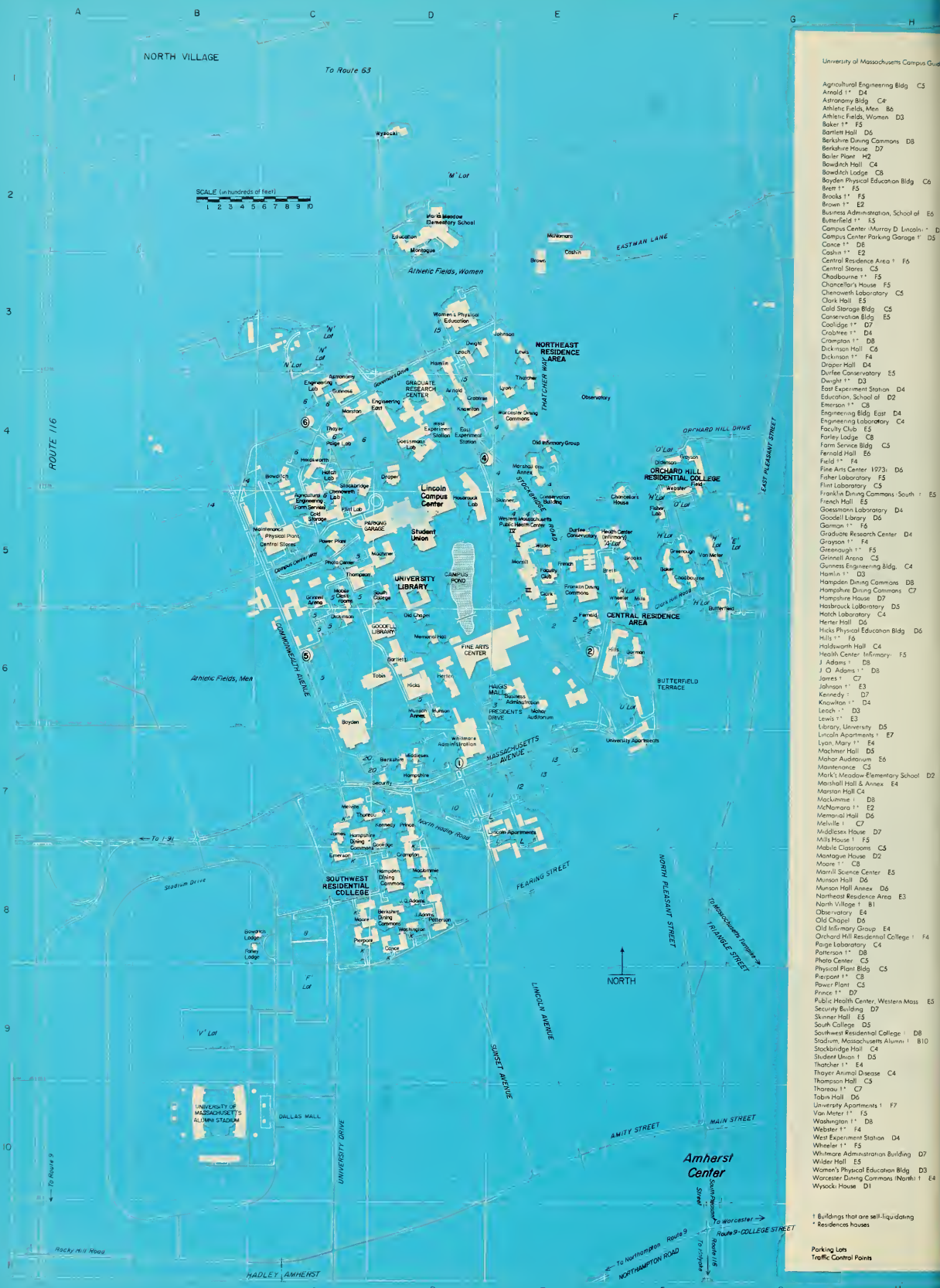


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1 2 3 4 5 6 7 8 9 10

University of Massachusetts Campus Guide



- Agricultural Engineering Bldg C5
- Amold 1st D4
- Astronomy Bldg C6
- Athletic Fields, Men B6
- Athletic Fields, Women D3
- Baker 1st F5
- Bartlett Hall D6
- Berkshire Dining Commons D8
- Berkshire House D7
- Beller Plant H2
- Bowditch Hall C4
- Bowditch Lodge C8
- Boyle Physical Education Bldg C6
- Brett 1st F5
- Brooks 1st F5
- Brown 1st E2
- Business Administration, School of E6
- Butterfield 1st D3
- Campus Center (Murray D Lincoln) D1
- Campus Center Parking Garage 1st D5
- Coxe 1st D6
- Cohan 1st E2
- Central Residence Area 1st F6
- Central Stores C5
- Chadbourne 1st F5
- Chancellor's House F5
- Chenoweth Laboratory C5
- Clark Hall E5
- Cold Storage Bldg C5
- Conservation Bldg E5
- Coolidge 1st D7
- Croft 1st D4
- Croft 1st D8
- Dickman Hall C6
- Dickman 1st F4
- Drapier Hall D4
- Duffee Conservatory E5
- Dwight 1st D3
- East Experiment Station D4
- Education, School of D2
- Emerson 1st C8
- Engineering Bldg East D4
- Engineering Laboratory C4
- Faculty Club E5
- Farley Lodge C8
- Farm Service Bldg C3
- Fernald Hall E6
- Field 1st F4
- Field Art Center 1973 D6
- Fisher Laboratory F5
- Flint Laboratory C5
- French Dining Commons South 1st E5
- French Hall E5
- Gossoms Laboratory D4
- Goodell Library D6
- Gorman 1st F6
- Graduate Research Center D4
- Grayson 1st F4
- Greenough 1st F5
- Greenough Annex C5
- Guinness Engineering Bldg. C4
- Hamlin 1st D3
- Hampden Dining Commons D8
- Hampshire Dining Commons C7
- Hampshire House D7
- Haskins Laboratory D5
- Hatch Laboratory C4
- Heller Hall D6
- Hicks Physical Education Bldg D6
- Hills 1st F6
- Holdsworth Hall C4
- Health Center Infirmary F5
- J Adams 1st D8
- J O Adams 1st D8
- Jones 1st C7
- Johnson 1st E3
- Kennedy 1st D7
- Kiswilt 1st D4
- Leach 1st D3
- Levin 1st E3
- Library, University D5
- Lincoln Apartments E7
- Lynn May 1st E4
- Machmer Hall D5
- Mahar Auditorium E6
- Maintenance C5
- Mark's Meadow Elementary School D2
- Wash Hall Hall & Annex E4
- Manson Hall C4
- MacLennan 1st D8
- McNamara 1st E2
- Memorial Hall D6
- Melville C7
- Middlesex House D7
- Milly House 1st F5
- Moble Classrooms C5
- Montague House D2
- Moore 1st C8
- Morial Science Center E5
- Munson Hall D6
- Munson Hall Annex D6
- Northeast Residence Area E3
- North Village 1st B1
- Observatory E4
- Old Chapel D6
- Old Infirmary Group E4
- Orchard Hill Residential College 1st F4
- Pease Laboratory C4
- Patterson 1st D8
- Photo Center C5
- Physical Plant Bldg C5
- Pierpont 1st C8
- Power Plant C5
- Prescott 1st D7
- Public Health Center, Western Mass E5
- Security Building D7
- Shinner Hall E5
- South College D5
- Southwest Residential College D8
- Sidney, Massachusetts Alumni 1st B10
- Stockbridge Hall C4
- Student Union 1st D5
- Thatcher 1st E4
- Thayer Animal Disease C4
- Thompson Hall C3
- Thoreau 1st C7
- Tobin Hall D6
- University Apartments 1st F7
- Van Meter 1st F5
- Washington 1st D8
- Webster 1st F4
- West Experiment Station D4
- Wheeler 1st F5
- Whitmore Administration Building D7
- Wilder Hall E5
- Women's Physical Education Bldg D3
- Worcester Dining Commons (North) 1st E4
- Wysock House D1

1 Buildings that are self-liquidating
2 Residences houses

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*1972-1973
Undergraduate Course and
Faculty Directory
Amherst*

University of Massachusetts Bulletin

The Undergraduate Catalog of the University of Massachusetts at Amherst consists of the Courses and Faculty Bulletin and the General Information Bulletin. All students are responsible for observing the rules and regulations thus published, as well as those published in the Student Handbook. The University reserves, for itself and its departments, the right to change its announcements or regulations whenever such action is deemed appropriate or necessary.

It is the policy of the University of Massachusetts that any and all acceptance of students for admission be without regard to sex, creed, race, color, or national origin.

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MARCH, 1972
NUMBER 2

Published eleven times a year by the University of Massachusetts in February, March (3), June, August (2), September, November, and December (2). Second Class postage paid at Amherst, Massachusetts 01002 and at additional mailing offices. The University Undergraduate Catalog for the 1972-1973 academic year is part of the One Hundred and Eighth Annual Report of the University of Massachusetts and as such is Part II of Public Document 31, Section 8, Chapter 75, of the General Laws of Massachusetts.

1972-1973
*Undergraduate
Courses and Faculty*

*University of Massachusetts
at Amherst*

1972-1973 Academic Calendar

1972

Tuesday, September	5	Registration Day 1, Undergraduate
Wednesday, September	6	Registration Day 2, Graduate
Thursday, September	7	Registration Day 3, Undergraduate
Friday, September	8	First day of classes
Monday, October	9	Holiday
Monday, October	23	Holiday
Wednesday, October	25	<i>Monday class schedule</i> will be followed
Monday, November	13	Counseling period begins (classes NOT suspended)
Friday, November	17	Counseling period ends
Tuesday, November	21	<i>Thursday class schedule</i> will be followed
Wednesday, November	22	Thanksgiving recess begins after last class
Monday, November	27	Classes resume
Wednesday, December	13	Last day of classes
Thursday, December	14	Reading day
Friday, December	15	Final examinations begin
Saturday, December	23	Last day of final examinations
Saturday, December	23	Semester ends at 12:30 p.m.

1973

Monday, January	22	Registration Day 1, Undergraduate
Tuesday, January	23	Registration Day 2, Graduate
Wednesday, January	24	Registration Day 3, Undergraduate
Thursday, January	25	First day of classes
Monday, February	19	Holiday
Friday, February	23	<i>Monday class schedule</i> will be followed
Friday, March	23	Spring vacation begins after last class
Monday, April	2	Classes resume
Monday, April	16	Holiday
Thursday, April	19	<i>Monday class schedule</i> will be followed
Monday, April	23	Counseling period begins (classes NOT suspended)
Friday, April	27	Counseling period ends
Saturday, May	12	Last day of classes
Monday, May	14	Reading day
Tuesday, May	15	Final examinations begin
Wednesday, May	23	Last day of final examinations
Saturday, May	26	Commencement

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*All regular semester courses meet for three class hours each week unless otherwise indicated. All courses carry three credits unless otherwise stated. Courses have no prerequisites unless listed.

The Board of Trustees

Organization of 1972

Term Expires

ROBERT M. ABRAMS of Holyoke	1977
FRANK L. BOYDEN of Deerfield	1974
KEVIN R. CARMAN '72 of Cambridge	1972
EDMUND J. CROCE of Worcester	1977
DENNIS M. CROWLEY of Boston	1973
ROBERT D. GORDON of Lincoln	1978
JOHN W. HAIGIS, JR., of Greenfield	1974
JOSEPH P. HEALEY of Arlington	1977
MRS. ELIOT S. KNOWLES of South Dartmouth	1974
LORENZO D. LAMBSON of Southwick	1973
JOHN J. MAGINNIS of Worcester	1972
GEORGE L. PUMPHRET of Dorchester	1974
MRS. GEORGE R. ROWLAND of Osterville	1972
LEE H. SANDWEN '72 of Annandale, Virginia	1972
ALAN SHALER of Easthampton	1977
MRS. O. PHILLIP SNOWDEN of Roxbury	1976
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CHRISTOPHER J. WELDON of Springfield	1976

Ex Officio

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General Academic Regulations

Attendance

The attendance of students at all regularly scheduled classes at the University is expected. No administrative control of attendance is exercised except as hereinafter provided. In cases of illness, students are to explain their absences directly to their instructors. The grade of the student who has met the requirements of the instructor in making up his work shall not be reduced for absence because of illness. Students are not to be penalized for official off-campus trips.

Conduct

The customary high standard of college men and women in honor, self-respect, and consideration for the rights of others constitutes the ideal of student conduct. The privileges of the University may be withdrawn from any student at any time if such action is deemed advisable. It should be understood that the University, acting through the President or any administrative officer designated by him, distinctly reserves the right, not only to suspend or dismiss students, but also to name conditions under which they may remain in the institution. Hazing in the sense of the punishment or humiliation of students is not permitted.

Grade Reporting and Academic Regulations

Enrollment in and graduation from the University involve both quality and quantity of work. The quantity of work is measured by the credits obtained by successful completion of courses. The quality of work is measured by grades. Each grade is equated with a quality point as noted below.

GRADING SYSTEM

The aims of the letter system of grading are to divorce the evaluation of student achievement from any rigid numerical system and to encourage judgment on the basis of total performance. This philosophy recognizes that performance measurement is a relatively inexact art.

Each instructor may use some numerical system of preliminary grading in order to evaluate examinations, papers, laboratory work, etc.; many will

use the traditional percentage method. However, it is not automatically assumed that 80–89 is a B or that 90–99 is an A, or that the grading pattern is to be fitted to a given performance curve. A student's performance is evaluated on its own merits and the final grade awarded according to the definitions accompanying the letter grades.

No matter what system of grading is used close decisions will always have to be made — sometimes to the apparent advantage of the student and sometimes to his disadvantage. Proper use of the letter grading system, however, avoids emphasis on fine distinctions which may merely be manifestations of the grading device, rather than real differences in student performance.

Effective with the Fall Semester, 1971, the official grading system is:

A, AB, B, BC, C, CD, D, F, W, Inc.,

with the following grade points: A = 4.0, AB = 3.5, B = 3.0, BC = 2.5, C = 2.0, CD = 1.5, D = 1.0.

The grade of F, while being recorded, is no longer included in the quality point calculations. A student who withdraws from a course within the first eight weeks of the semester receives a W; withdrawal after that period is recorded as an F. An Incomplete indicates that the course work has not been finished. If no final grade is reported to the Registrar before the end of the course add period of the following semester, the Incomplete will be changed to an F by the Registrar.

No course marked W, F, or Inc., earns graduation credit for a student. Such a course may be repeated for credit. A course marked with a grade of D may be repeated for a higher grade but *not for additional credit*. If a D course is repeated, both grades will be used in computing Q.P.A.s.

UNDERGRADUATE ACADEMIC REGULATIONS

The new academic regulations were designed primarily to support the student in his progress toward his academic degree. The regulations require that schools, colleges, and departments give special attention to students who are having academic difficulties, whatever the reasons. They will also allow the University to identify as quickly as

possible, in order to provide appropriate counseling, those students whose progress seems to indicate that the probability of their achieving their degree objective is small. The new regulations also raise flags if students are not making normal progress toward a degree (at least 12 graduation credits per semester) as well as if they are not meeting minimum standards.

Academic Status Categories:

A. Definition:

At the end of each semester, the student's performance to that time puts him into one of the following five categories and, except as noted below, he will be in this category during the next term he enrolls:

1. *Academic Good Standing*: Means that the student is making satisfactory progress, both qualitatively and quantitatively, toward graduation.
2. *Academic Warning*: Means that the student is not making satisfactory qualitative and quantitative progress toward graduation. A student in this category must have his program of studies for his next semester reviewed by his Academic Dean (or duly authorized faculty agent) before he can validate his registration for that next semester. The Academic Dean may, on the written recommendation of an appropriate agency, change the category to Academic Good Standing.
3. *Academic Probation*: Means that continuation at the indicated rate will not lead to required graduation average within ten semesters. A student whose record puts him in this category for the first time must confer with his Academic Dean (or duly authorized faculty agent) about his status. The Academic Dean may: (1) on the recommendation of an appropriate agency, change the category to Academic Warning, or (2) permit the student to enroll in the category of Academic Probation, in many cases with restrictions on the course program. The student may appeal the Academic Dean's decision to the Board of Admissions and Records. In this case, both the student's petition and the reasons for the Dean's action are submitted in writing; neither appears before the Board unless the Board asks both to come.
4. *Academic Suspension*: Means that the student may not enroll for the semester immediately following suspension. After a first academic suspension and an absence of at least one semester he can apply for readmission. A student who returns after a period in the Academic Suspension category must have

his academic program reviewed by the Academic Dean (or an authorized agent) and will have academic status reviewed at the end of the semester. A student in the Academic Suspension category may not live in University housing, represent the University in any way, or hold a job on campus. A second academic suspension results in academic dismissal.

5. *Academic Dismissal*: Means that the student has been permanently separated from the University.

B. Procedural Rules:

1. Records for students will indicate Academic Warning, Probation, Suspension and Dismissal for internal purposes. Transcripts will show Suspension and Dismissal.
2. A student in Academic Good Standing may interrupt his studies indefinitely and be re-admitted (on application) in the same standing.
3. A student with Academic Warning may interrupt his studies indefinitely and be re-admitted (on application subject to approval of his program of study by his, perhaps new, Academic Dean) in the same standing.
4. Summer Session work may raise or lower a student's standing.
5. A student is placed in Academic Suspension category after: (a) a second assignment to Academic Probation, (b) two assignments to Academic Warning and one to Academic Probation in consecutive semesters; or (c) four consecutive assignments to Academic Warning. Academic Dismissal will occur after a second Academic Suspension.

C. Criteria For Categories:

1. *Academic Good Standing* results from achieving the following cumulative average and graduation credit during the semester just completed.
 - a. A cumulative average of at least:
 - 1) 1.8 for first semester students
 - 2) 1.9 for students after two semesters
 - 3) a cumulative average of 2.0 and at least 1.8 semester average thereafter
 - b. Completing credits:
 - 1) At least 12 n after n semesters and
 - 2) At least 12 n in most recently completed and current semester
2. *Academic Warning* results from the student not qualifying for either Academic Good Standing or Academic Probation.
3. *Academic Probation* results from:
 - A cumulative average less than 1.3 for all

first semester students, less than 1.5 for regular students at the end of their second semester, less than 1.7 for regular students at the end of their third semester, less than 1.9 for all others.

PASS/FAIL COURSES

The purpose of the Pass/Fail program is to encourage full-time students to be usefully venturesome in the choice of their elective courses.

Any full-time undergraduate shall be eligible to use a pass/fail option in one course each semester. A student may elect to take up to and including five (5) University core requirement courses pass/fail. For courses required for a student's major, permission of the department is necessary. An eligible student taking a full load in summer work (9 credits) may be allowed the pass/fail option in one course.

Each School, College or Division of the University is authorized to formulate and enforce its own pass/fail regulations concerning the number of such courses allowed beyond one course per semester pass/fail up to and including 15 courses in a student's undergraduate career.

Students who take courses in the School of Education and in the School of Physical Education to satisfy the physical education requirement shall not be deprived of their normal option to take another course on a pass/fail basis for that particular semester.

On Registration Day, each eligible student will receive a pass/fail eligibility card. The student has ten (10) days to decide whether to exercise this option and in which course to use it. The card is turned in directly by the student to the Registrar's Office. The Registrar's Office shall not inform the instructor that the course is being taken on a pass/fail basis. Students need not inform their instructor that they are taking a course on a pass/fail basis. A pass/fail course cannot be converted to a regular grading basis after the ten-day period has passed.

The Registrar's Office will send out the same course grading card for all students so that instructors will record an appropriate grade. The Registrar is empowered to translate grades A through D to the grade of "P" for a student who used his pass/fail option. A "P" in a course earns a student graduation credits, but the course is in no way counted in his quality point average calculation. A student who does failing work in a pass/fail course shall be given the grade of "F".

We would like to stress the fact that pass/fail is strictly a *student option*. The purpose of the pass/fail program is to encourage full-time students to be usefully venturesome in the choice of their elective courses. With very few exceptions, there are no mandatory pass/fail courses other than in the School of Education.

Students who sign up for mandatory pass/fail courses outside the School of Education have to use their one and only pass/fail option for that particular semester, which does not give them a chance to experiment by taking an elective course pass/fail.

FINAL EXAMINATIONS

It is University policy not to require a student to take more than two final examinations in one day. Any student who finds he has a conflict in his examination schedule or more than two in one day should report this to the Schedule Office, 168 Whitmore Administration Building.

GRADUATION REQUIREMENTS

It is the responsibility of the individual student to review his own progress toward graduation and the fulfillment of University and school requirements. Through his own initiative, he should address questions concerning these matters to his adviser, Dean, or the Registrar. It is each student's responsibility to submit a diploma card at the beginning of his expected year of graduation to set the graduation process in motion. The card, submitted to the Registrar's Office, must be complete and accurate.

All four-year curricula of the University conform to the following basic conditions:

Quality Point Average

The graduation requirement is a cumulative average of 2.0. A transfer student must satisfy the cumulative quality point average of the class to which he is assigned. Students originally assigned to a class prior to 1972, if they have earned 60 or more credits in their previous class designation, will be held only to the previous class designation graduation average.

Accumulated Credits

- A. The successful completion of at least 120 semester hours of academic credit. Individual colleges, schools, divisions and departments may require more than 120 semester hours of academic credit.

Core Curriculum Requirements

In addition to the requirements for all students listed below, each school or college and major program has additional requirements to be found in other parts of the Bulletin.

- B. An introduction to the theory and practice of writing and speaking, and to the study of communication in our society by the successful completion of two courses in Rhetoric, one of which must be Rhetoric 100 or Rhetoric 110, chosen from those identified by the letter "B" in this Bulletin.

- C. An introduction to the humanities and fine arts by the successful completion of three courses chosen from those identified by the letter "C" in this Bulletin.
- D. An introduction to the social and behavioral sciences by the successful completion of three courses chosen from those identified by the letter "D" in this Bulletin.
- E. An introduction to mathematics and the natural sciences by the successful completion of three courses chosen from those identified by the letter "E" in this Bulletin.
- F. Intensive or specialized work in a particular department, division, school or college constituting a major and consisting of the successful completion of at least fifteen semester hours of credit in junior-senior courses in the area of the major.
- G. A basic physical education course of two semesters' duration is required of all students. The course is PE 100 and carries one credit per semester. A transfer student awarded 15 or more transfer credits must complete the physical education semesters of the class to which he is assigned (i.e. a transfer student given 15 transfer credits must complete one semester of physical education). A transfer entering with an Associate Degree from an accredited institution is exempt from physical education. Students who originally enroll in this University, subsequently transferring in work from other institutions, may be awarded physical education waivers congruent with those given to transfer students. Veterans are not automatically awarded waivers.

HONORS

University Honors Groups

At the beginning of each semester a list is published of those students who, during the previous semester, made a semester grade point average of 3.0 or higher while carrying 12 or more regularly graded credits (other than pass grades). Three groups are recognized as follows:

First Honors — 3.8 (3.75) or higher;

Second Honors — 3.4 (3.35) to 3.7 (3.74) inclusive;

Third Honors — 3.0 (2.95) to 3.3 (3.34) inclusive.

Graduation with Distinction

High ranking students will be graduated as follows:
Summa Cum Laude — Cumulative average 3.80 or higher;

Magna Cum Laude — Cumulative average 3.40 to 3.79 inclusive;

Cum Laude — Cumulative average 3.00 to 3.39 inclusive;

A transfer student, to be eligible for consideration for graduation with distinction, must have earned his final 60 semester hours of credit in residence at the University, 48 of which must have been taken and passed on a regularly graded basis (other than pass grades).

Reports and Transcripts

Final Grades:

Fall semester: distributed to students at registration and mailed to parents.

Spring semester: mailed to homes.

Summer semester: one report printed at end of summer for all summer courses. Distributed to students at fall registration or mailed home.

Two transcripts of a student's record will be furnished without cost by the Registrar's Office. For each additional copy there will be a charge of \$1. No transcript is issued without the student's written request. A partial transcript is never issued.

General Requirements

RESIDENCE

It is the policy of the University that the final year's scholastic work be taken in residence, which is defined for this purpose as continuous enrollment and regular attendance in classes conducted on the campus of the University. This requirement may be waived by the Board of Admissions and Records upon recommendations of the major department and Dean of the college or school. Such approval should be obtained in advance of undertaking the degree *in absentia*. The Board may also waive the requirement for a student admitted to an appropriate professional school after completion of six or more semesters of work at the University, provided:

1. That the cumulative average at the University is 2.5 or higher.
2. That satisfactory evidence is presented indicating completion of work comparable to that offered at the University in amount sufficient to satisfy requirements for the appropriate bachelor's degree.
3. That the major department and Dean of the College or School approve.

No student is allowed more than ten semesters, including semesters at other colleges, to attain the required graduation average. Twelve accumulated semester credits earned in summer schools at the University or other colleges constitutes a semester. A student who maintains the required graduation average but is deficient in course requirements may continue enrollment until his course requirements are completed.

A student must successfully complete a minimum of 45 credits in residence to be considered for the baccalaureate degree.

A student will be terminated for academic deficiency at the end of seven, eight, or nine semesters if he has failed to satisfy the cutting point requirements of his class set for the seventh semester. A student so terminated may apply for readmission under the usual conditions.

DINING

All freshmen, sophomores and juniors residing in University residence halls will be required to board at University dining halls except that such students who are members of fraternities or sororities may be permitted to board at the respective fraternities or sororities by permission of the appropriate student personnel dean. University board is optional for seniors and is available on a cash basis.

PAYMENTS DUE

Diplomas, transcripts of record, and letters of honorable termination will be withheld from all students who have not paid all bills and all loans due the University. All such bills due the University must be paid ten days preceding Commencement. If paid after that date and the student is otherwise eligible, he may graduate the following year.

Registration

PRE-REGISTRATION

Every student must pre-register during the designated period. Students who pre-register late will be charged a fee of \$5. A student who does not pre-register will forfeit his option to register for the following semester and must submit an application for readmission (within the stated deadlines) before being allowed to register again.

LATE REGISTRATION

Each student must report for registration on the appointed day. Late registrants must pay a \$5 fine.

COURSE REGISTRATION

No course will be recorded on the permanent records of the University nor will a student receive credit for it unless he has registered for such a course in accordance with established procedure on a regularly scheduled registration day or unless his registration shall have been made official by a Course Add Card filed with the Registrar.

No instructor should allow a student to enter his class unless the student was officially enrolled on a regularly scheduled registration day or has submitted a Course Add Card authorizing his admission to the class. A course dropped without the approval of the Registrar will be treated as a Failure.

ACADEMIC REGULATIONS

Course Enrollment and Withdrawals

A. General Regulations

1. Course Loads

The normal credit load is at least 15 credits. Regular students will carry a minimum of 12 credits. The maximum semester credit load is established by the appropriate school or college. Only students of high academic standing (cumulative averages of 2.5 and above) will be permitted to take an overload of one course with the approval of the academic dean involved and of two courses with the approval of the Dean and the Provost. Approval forms are available in the Office of the Registrar. Seniors in their final two semesters may carry an overload of one course each semester without special permission if such an overload will enable them to graduate, or an overload of two courses each semester with the approval of the academic dean. Seniors needing six or more courses totaling at least 18 credits to graduate may elect to distribute their course load over their final two semesters. Under this arrangement, reduced load permission is not required to carry less than 12 credits.

2. Certification of Course Changes

To add, drop, or change a course, the student must obtain the signature of the instructors concerned, the faculty adviser (if required by his major department), and the appropriate officer in the Registrar's Office. Signed cards are to be filed with the Registrar. Instructors and advisers are referred to the Manual for Faculty Advisers for specific information.

3. Exceptions to the Regulations

Exceptions to these regulations are made only in cases of protracted illness, critical personal or academic problems, and then only with the approval of the student's Academic Dean based upon recommendation of the appropriate office among the following: Health Services, Area Coordinators, Dean of Students, Dean of Women, or Counseling and Guidance Office.

B. Course Registration Changes

ADD PERIOD – Within the period of up to and including ten academic days from the beginning of a semester a student may add, drop, or substitute a course without notation on his record. Monday through Saturday are defined as full academic days. No courses may be added after this period.

W PERIOD – Within the period of the 11th academic day and up to and including the eighth academic week from the beginning of a semester a student may drop a course subject to the minimum load regulation above; the notation of withdrawal on his record as a W is the only record.

F PERIOD – After the eighth academic week and subject to general regulations above, a student may not drop a course without having an F entered on his record at the time of withdrawal.

C. *Withdrawal from the University*

Prior to the eighth academic week, when a student withdraws from the University, grades of W will be noted on his record. The portion of the semester will not count as one of the ten semesters permitted toward attaining the graduation average.

After the eighth academic week, grades of WF or WP will be entered, as appropriate, for all courses in which the student is enrolled. The semester will count as one of the ten semesters permitted for attaining the graduation average.

CHANGE OF MAJOR

A student wishing to change his major must get a Major Change Card at the Registrar's Office. This change is to be approved by the head of the department or school in which he is now majoring and also by his new major adviser. This card, properly endorsed, must be returned to the Registrar's Office before the change receives final approval. As part of the major change procedure, the student takes his Academic Records Folder to the new department. It is very important that the student notify the Registrar's Office of all changes of major as well as inaccuracies concerning his major. This is especially important during the junior and senior years.

Classification of Undergraduate Part-Time Students

A. *Degree Students*

1. *Full-Time Students*

All students carrying 12 or more credits must be accepted as degree candidates and assigned to a graduating class.

2. *Reduced Load Students*

Full-time students may obtain exemption from the minimum load requirements set by the Faculty Senate only upon approval of their academic dean based upon recommendation of the appropriate one of the following: Health Service, Deans of Men, Women, or Students, or Counseling and Guidance Office. Such exemption is

ordinarily not granted except upon the basis of health or critical personal or academic problems. A regular student may not enter the non-classified degree category nor the special (non-degree) category.

Reduced load students are considered as full-time students in *all* benefits, fees, and obligations. They continue in a class designation. The only exception made in their case is to the minimum load regulation. Although reduced load students carry less than the minimum load, the appropriate semester and cumulative quality point requirements for retention do apply and the semester counts as one of the ten towards graduation. Reduced load students bear a regular Student I.D. card.

3. *Non-Classified Degree Students*

Students who are admitted to degree status on the same basis as full-time students, but with the expectation of only part-time pursuit of the degree are considered *Non-classified Students*. They are given a classification of "NC." For their initial enrollment they are processed as incoming freshmen or transfer students. They are assigned to a major department, to provide appropriate counseling and pre-registration advising.

Non-classified students are not entitled to student benefits, other than departmental support. They are billed by the credit with other fees assessed only as appropriate to Special Students (below). At pre-registration a special billing card is filled out by student and adviser. To be eligible for continued enrollment, non-classified students must maintain a cumulative average equal to the graduation average of the University. They bear a Special Student I.D. card.

The category "Non-Classified" is an original admissions category and is not designed as a category into which full-time students may revert for purposes of part-time study.

B. *Non-Degree Students*

1. *Special Students*

A transient student accepted for one or two courses on a *non-continuing* basis is assigned to this category (Class designation "SP"). No evaluation of transfer credentials or course advising is offered to students in this category nor are they entitled to any student benefits. Their con-

tinuance is not automatic, but at the discretion of the appropriate admissions officer. A minimum of the graduation average of the University is required for an "SP" to continue. They bear a Special Student I.D. card. Regular students may not revert to this category for purposes of part-time study.

Special Course Registration

ADVANCED PLACEMENT

If a student is given advanced placement by a placement examination or by some other means, he will be given credit but no grade for the omitted work. He will be considered to have completed any requirement represented by the omitted work. Credit without grade awarded in this manner will be treated as transfer credit and not computed in quality-point averages.

AUDITING

A full-time undergraduate student may audit a course by presenting his I.D. card to the instructor of the course, provided that the instructor can accommodate the auditor in his class, believes that the student has sound academic reasons for the audit and has the proper preparation. The student will be expected to pay laboratory fees, where applicable. The audited course is not represented in any way on the student's permanent record.

CREDIT BY SPECIAL EXAMINATION

The requirements of any course approved for credit may be met by examination upon arrange-

ment with the dean of the school or college and the head of the department offering the course. All such arrangements must be completed prior to the mid-semester. A student who has been a full-time degree student but who is on leave and in good academic standing is eligible to take *one* or *two* courses in this fashion. No student may earn more than 30 credits in this manner. Grades and credits of courses taken by examination are included in the quality point average calculations. Forms may be obtained in the Registrar's office.

CREDIT FOR WORK COMPLETED AT FOREIGN INSTITUTIONS OR IN MILITARY SERVICE

Students seeking credit for work taken at foreign colleges or for service-connected educational experiences must apply to the Registrar. Frequently credit may not be granted for such work without approval of the department concerned. No student will automatically receive credit for any specific course. Each case must be decided according to appropriate criteria.

UNDERGRADUATES TAKING GRADUATE LEVEL COURSES

Registration of an undergraduate in a graduate course numbered in the 400, 700, or 800 series is subject only to the permission of the course instructor. An undergraduate student who wishes to register in a graduate course numbered in the 500 or 600 series must file a specific authorization, issued by the Head of the Department offering the course, with the undergraduate Registrar.

Special Programs

Bachelor's Degree With Individual Concentration

The new Bachelor's Degree with Individual Concentration is a two-year program, supervised by an interdisciplinary faculty committee rather than by a traditional department. The program will lead to either a Bachelor of Arts or a Bachelor of Science degree with Individual Concentration. The work for the degree, normally in the sophomore and junior or junior and senior years, will take the place of the traditional major. The program the student designs for himself usually will draw upon courses currently offered by more than one department, school or college of the University. (Five College courses could be appropriate in some cases.) Together, these courses should constitute a program not otherwise available to the student in any manner. Some general programs might be, for example, Private and Performing Arts, Urban Studies, American Civilization, or Behavioral and Natural Science. In each case, the course of study will be developed by the individual student with the approval of his faculty sponsor, and the committee supervising the program. The chairman (and the committee) report to the Office of the Provost, as provided in the Trustee approval of the BDIC program.

Any sophomore or junior with a 2.0 quality point average and with at least four semesters of undergraduate work remaining is eligible.

Application Procedures: First, the student must have in mind both a personal or professional goal for his proposed studies, and a related combination of courses not offered in any regular department or interdisciplinary program at the University. He should present this program — with three interrelated courses for each of the first two semesters — in a formal statement that demonstrates their interrelation for his own particular purposes. Second, he should locate some one member of the University faculty who, after reading the statement, agrees to serve as his sponsor, helping him to evaluate his program as he proceeds and helping him, too, to choose later courses based on the results of his first semesters. Most course work should be drawn from the offerings in this undergraduate Course and Faculty Directory; although some departments, under "Special Problems" headings, offer wide possibilities. In some cases off-campus projects under sponsor supervision or work at other universities may be used. The program also has its own course listings for special projects. The faculty sponsor should be familiar with the student's principal field of interest. Third, the formal statement and a cover letter naming the sponsor should be

forwarded, in person or by mail, to a member of the supervising committee. These men are: Professor Anthony Borton (Veterinary and Animal Sciences), Stockbridge Hall; Professor Arthur Kinney (English), Bartlett Hall; Professor W. Leigh Short (Chemical Engineering), Goessmann Laboratory. A representative of the faculty committee will contact the student regarding the status of his proposal, once it has been evaluated.

Note: (1) The degree earned will be either the B.A. or B.S., depending upon the area in which the greater concentration of advanced work is done; (2) Students seeking this degree must still fulfill the usual University core and distribution requirements, which are (a) the completion of 120 credit hours, (b) the achievement of the 2.0 graduation average, and (c) core and distribution courses. For special waivers (not normally granted), students are asked to consult a member of the supervising committee.

University Honors Program

The University Honors Program offers unusual opportunities for the superior student who is willing and able to engage himself seriously in the learning process. The features of the Program are, briefly, as follows:

1. An individualized schedule of studies;
2. Thoughtful guidance by a preceptor, a specially selected professor;
3. Special honors courses;
4. An opportunity to take advantage, as early as the freshman year, of the riches of a large University and four famous private colleges, with informed counseling about course offerings.

Each student prepares, with the aid of his preceptor, a plan of studies designed to meet the student's abilities, interests and needs. Each preceptor is a member of the faculty especially interested in working closely with serious and able students. His responsibilities include not only helping select courses but also guiding the student's intellectual development. Among the preceptors are some of the most distinguished members of the faculty as well as younger professors of great ability.

The special requirements of the Honors Program are few. A Commonwealth Scholar is expected to take one special honors course each semester during his freshman and sophomore years, and a total of twelve honors credits during his junior and senior years. The freshman-sophomore honors courses have three characteristics: they are usually

available only to Commonwealth Scholars, with classes typically including only some sixteen students; they deal with selected topics treated in depth (they are not survey courses); and they emphasize discussion and the writing of papers instead of lectures and objective testing.

The junior-senior honors credits may be obtained from honors interdisciplinary seminars, special honors projects, honors courses in one's major (where available), independent study, and Five-College course offerings.

The Honors Program is open by invitation only. Acting Director of the program is Dr. W. Brian O'Connor. Assistant Director is Dr. Robert Keefe. The Honors Committee includes Drs. Doris Abramson, Howard Quint, Ellen Reed, and T. O. Wilkinson. The Honors Offices are in Machmer Hall.

Senior Departmental Honors — Departmental Honors are designed to give highly qualified students time and opportunity for independent study in their major field. To be eligible for admission, a student should have a cumulative average of 3.0 or higher for the first five semesters of university work and demonstrate outstanding promise in his major field. In exceptional cases students who have averages lower than 3.0 but show unusual aptitude for independent work may be accepted if a written statement establishing this is presented to the Director of Honors. During the senior year, honors candidates carry forward their independent study each semester in the department of the major. Six credits (or in some cases, nine) are awarded at the completion of the project, displacing two regular 3-credit courses during the senior year. A Departmental Honors candidate is assigned a committee of three faculty members who supervise the study and the preparation of a thesis, which is defended orally. If he satisfies all the requirements of his department and the Honors Program, attaining a grade of B or higher, the candidate is awarded honors in the field of his specialization upon graduation. Those with passing grades lower than B receive special projects credit toward their degree.

Orchard Hill Residential College Program

Master: Professor Leon Barron; Area Co-Director: West; Faculty Residents: Allen (Political Science), Frank (History), Sitter (English), White (History). Preceptors: Allen (Political Science), Brentlinger (Philosophy), Johnson (Food and Agricultural Engineering), Savereid (Speech).

Orchard Hill Residential College is a complex of four dormitories, offering a variety of cultural and social programs for students seeking a personalized, creative college experience.

Each dormitory houses one resident faculty member, and has associated with it a Preceptor as

coordinator of a large number of non-resident Faculty Fellows. Faculty participate with students in projects of mutual interest such as dorm dinners, panel discussions, film series and projects of a social action nature.

Whenever possible, Fellows conduct their sections of University "core" courses or Orchard Hill's own three-credit courses within the residence halls. Some of these courses may be taken as core requirements. In addition, one-credit colloquia, often created by students, are offered to meet specific, immediate educational needs. Most Orchard Hill courses have sprung from students' appreciation of what they need to know, and all are interdisciplinary in nature. Much of the impulse behind the commitment to an integrated, interdisciplinary program has come from a growing concern over the increasing departmentalization of learning, evident now even in most introductory, lower-level courses.

Although Orchard Hill residents are given first preference, these courses may be elected by any other students of the University or the other four colleges who have secured permission of the Master's Office.

Orchard Hill faculty and students have become increasingly sensitive to the fact that such an experimental college must begin to deal with the isolation of students from the society which the University serves. Current activities which reflect this recognition include a Student-Labor Relations Project, the Orchard Hill Tutorial Project in Holyoke, and a cooperative venture with the Westfield Detention Center.

Although Orchard Hill Residential College is at present unable to offer its own majors, it is possible for students to design with Orchard Hill faculty individualized majors under the B.D.I.C. program (see Bachelor's Degree with Individual Concentration).

Students who wish to live at Orchard Hill, once accepted by the University, must apply through the College Admissions Committee. Applications may be obtained at the Master's Office, 101 Eugene Field House, where brochures are also available upon request.

All the courses listed on page 132 will not necessarily be offered in 1972. Please check with the Master's Office before registering for any Orchard Hill course.

Program in Computer and Information Science

See page 131.

Program in Marine Sciences

See page 133.

Five College Courses

Amherst, Mount Holyoke and Smith Colleges and newly formed Hampshire College and the University of Massachusetts combine their academic activities in selected areas for the purpose of extending and enriching their collective educational resources. Certain specialized courses not ordinarily available at the undergraduate level are operated jointly and are open to all. In addition, a student in good standing at any of the institutions may take a course without cost to the student, at any of the others if the course is significantly different from any available to him on his own campus, and he has the necessary qualifications. The course must have a bearing on the educational plan arranged by the student and his adviser. Approval by the student's adviser and the Academic Dean of the College (Provost at the University) at the home institution is required. Permission of the instructor is required for students from other campuses if permission is required for students of the institution at which the course is offered.

Students should apply for interchange courses at least six weeks prior to the beginning of the semester since they may find some courses already filled after that time. Free bus transportation among the five institutions is available for interchange students.

Students interested in such courses will find current catalogs of the other institutions and the University's Summer Session in departmental offices, the University Library or the Office of the Registrar. Applications may be obtained from the Office of the Provost.

Freiburg Program

In cooperation with the University of Freiburg, Germany, the University of Massachusetts operates a year-long Freiburg Program. The University of Massachusetts has a permanent facility in Freiburg, the Atlantic Studies Institute, which serves

as the headquarters of the Freiburg Program. Students enrolled in the Program are regularly enrolled students of the University of Freiburg, and take courses in a wide range of social science and humanities fields. The Freiburg Program is not restricted to students concentrating in German only, but admits students in philosophy, music, English, history, comparative literature and other fields.

Enrollment is limited to graduate students and superior upper division undergraduates with fluency in German. Students enrolled in other American colleges and universities may also apply. Candidates are expected to enroll in a special preparatory course and seminar which is offered in the spring semester, unless excused on the basis of language proficiency.

Cost for the two semesters in Freiburg, including transportation, is approximately equal to that of an academic year on the University campus.

CREDIT FOR STUDY ABROAD OR IN MILITARY SERVICE

Students wishing credit for academic study abroad must receive approval of the program they intend to follow abroad before they go overseas. Prior Approval Forms may be obtained at the Registrar's Office. All students must receive approval from their departmental adviser. Students in the College of Arts and Sciences must also receive approval from the Director of International Programs. Students in other schools and Colleges must obtain the approval of the dean of their school or college. This procedure helps to ensure that on re-enrolling in the University of Massachusetts the student will be granted credit for his study overseas. Students seeking credit for educational experiences connected with military service should consult the Registrar's Office.

For other study programs abroad, of less than a school year's duration, see the University's *General Information Bulletin*.

Directory of Courses

THIS DIRECTORY lists offerings available in each college, school, division, and department. Students should consult the index for the general fields under which specific courses may be found.

SUMMARY OF THE COURSE NUMBERING SYSTEM

- 000—099 Non-credit courses with no quality-point value toward graduation (such as courses needed to make up entrance deficiencies).
- 100—199 Undergraduate credit only: freshman-sophomore level.
- 200—399 Undergraduate credit only: junior-senior level.
- 400—499 Professional courses open to students having the bachelor's degree.
- 500—699 Courses available for graduate credit.
- 700—999 Graduate level courses.

Under normal circumstances, undergraduate students will be concerned only with courses

numbered below 400. Students interested in the University's program of graduate studies should consult the *Graduate School Bulletin*.

The following numbers are assigned to special courses and academic activities:

- 385—386 Special Problems, Undergraduate
- 398—399 Departmental Honors
- 390—394 Seminars, Undergraduate
- 700 Special Problems, Graduate
- 800 Master's Thesis
- 900 Doctoral Dissertation

Roman numerals indicate the semester(s) in which a course is given.

Capital letters appearing in parentheses after course titles designate various categories of courses required for graduation. For a full explanation of graduation requirements, see Page 5.

NOTE: *All regular semester courses meet for three class hours each week unless otherwise indicated; all courses carry three credits unless otherwise indicated. Courses carry no prerequisites unless specified.*

College of Agriculture

ARLESS A. SPIELMAN, *Dean*.

J. Richard Beattie, *Associate Dean*.

William J. Mellen, *Associate Dean*.

Ernest W. Buck, *Assistant Dean*.

John W. Denison, *Assistant Dean*.

Agricultural and Food Economics

Head of Department: Associate Professor N. E. Engel. Professors Brown, Crossmon, Foster, Leed, Russell, Storey; Associate Professors Bragg, Callahan, Christensen, Fitzpatrick, Jarvesoo, Marion; Assistant Professors Lee, Spindler; Instructor Verrees; Lecturer Schmittchel.

Majors will satisfy University and departmental graduation requirements as follows: 9 credits in humanities and fine arts, 6 credits in communication subjects, 6 credits in mathematics, 6 credits in natural sciences, 12 credits in economics, 6 credits in other social sciences, 6 credits in business courses, 3 credits in statistics, 12 credits in

technical offerings of the College of Agriculture appropriate to the special interest of the student in resource economics, agricultural economics, or food economics; and 15 credits in the major field.

Thirty-six credits in electives are available to be used in a program consistent with the student's major interest as developed with the adviser. It should be noted that majors in this department will take 6 credits in social sciences in lieu of 6 credits in natural sciences required of other majors in the College of Agriculture.

110 (I). WORLD FOOD AND NATURAL RESOURCES (D).

Introduction to the natural, economic, and sociopolitical forces influencing world food and biological resource development. Potentials for meeting pressures on resources. 2 class hours, 1 2-hour discussion.

Mr. Foster.

177 (I). BASIC BIOMETRY (E).

Introduction to applied statistical principles and techniques for biological data.

Mr. Russell.

206 (II). AGRICULTURAL ECONOMICS.

Intensive review of the agricultural sector. Application of economic principles to problems of production and marketing, elements of price making. Income problems of agriculture. Mr. Fitzpatrick.

235 (I). AGRICULTURAL BUSINESS MANAGEMENT.

Decision-making principles, management tools, analytical methods and their application to management problems of commercial farms and other agricultural firms. 2 class hours, 1 2-hour discussion. Mr. Lee.

261 (I). FOOD MARKETING SYSTEMS.

Structure of food marketing systems. Operating principles, significant product characteristics, role of specialized marketing firms, government programs and policies. Mr. Fitzpatrick.

265 (I). FOOD MERCHANDISING.

Economic analysis of factors, internal and external to the firm, influencing sales of food firms. Food industry development, consumer behavior, competitive strategies, and legal considerations. Mr. Marion.

341 (I). PRICE THEORY AND ANALYSIS.

A study of price theory and the analytic tools of economic analysis. Emphasis is placed on the application of quantitative techniques in the analysis of practical economic problems. Material is related to managerial decision making. Mr. Christensen.

352 (I). AGRICULTURAL POLICY.

Analysis of farm price support programs, programs for alleviation of rural poverty, food trade and aid policies, other topical issues. Mr. Storey.

368 (II). FOOD DISTRIBUTION ECONOMICS.

A critical analysis of the food industry; the legal and competitive framework, performance and public policy; management practices with respect to site selection, budgeting, merchandising, expense control and employee training and evaluation in food distribution firms. Mr. Leed.

373 (II). RESOURCE AND CONSERVATION ECONOMICS.

Economic and institutional factors affecting land and water use. Land use planning. Elements of conservation economics. Mr. Foster.

376 (II). MARINE RESOURCE DEVELOPMENT ECONOMICS.

Economic analysis of alternative plans for attainment of social goals in the development of coastal and offshore marine resources. Mr. Storey.

381 (II). INTERNATIONAL AGRICULTURAL DEVELOPMENT.

Economic development of low income rural economies. Relation of agriculture to national economies. Exogenous and endogenous factors in development. Mr. Foster.

385, 386. SPECIAL PROBLEMS.

Individual study of a selected problem for qualified students. By arrangement with members of the department. Credit, 1-3.

399 (I & II). DEPARTMENTAL HONORS.

Honors thesis work. Prerequisite, consent of Departmental Honors Committee. Credit, 6. Staff.

Entomology

Head of Department: Associate Professor T. Michael Peters. Professors Becker, Hanson, Lilly; Assistant Professors Edwards, Hall, Jensen, Stoffolano.

A departmental graduation requirement is successful completion of at least 15 semester hours of credit in Junior-Senior Courses (those numbered 200-399) offered by the Department of Entomology. The increased flexibility allowed by this change of requirements will enable students, in consultation with their advisers to build an individual program of courses that are more appropriately tailored to their future goals.

For students anticipating research or teaching careers which require graduate study, electives should stress basic sciences and liberal arts courses in botany, chemistry, English, modern languages, statistics, and zoology. Students interested in medical entomology should include microbiology, parasitology, and public health courses. For work in pest control, extension, quarantines, or agricultural chemicals, electives from plant pathology and soil sciences, forestry, business, speech, and applied entomology are recommended.

I26 (I), (II). GENERAL ENTOMOLOGY (E).

A survey of the field; structure, development, evolution, classification, biology, and natural control of insects. Formation of an insect collection. 2 class hours, 1 3-hour laboratory period. Mr. Peters.

I50 (I). PRINCIPLES OF APPLIED ENTOMOLOGY.

A broad basic course for both majors and non-majors. General principles of pest control stressed, instead of "how-to-do-it" details. 2 class hours, 1 2-hour laboratory period. Mr. Lilly.

260 (II). FOOD AND STRUCTURAL PESTS.

Identification, biology and specific control measures of arthropod and rodent pests in structures, foods, fabrics, and miscellaneous products during transportation and in homes. A prior course in zoology or entomology desirable. 2 class hours, 1 2-hour laboratory period. Mr. Lilly.

266 (II). PRINCIPLES OF APICULTURE.

Honeybees and their relatives, structure and biology of bees, methods of management, diseases, pollination, queen rearing, honey production, and history of beekeeping. Given in alternate years. Prerequisite, Entomology 126 or permission of instructor. 2 class hours, 1 2-hour laboratory period. Mr. Edwards.

272 (II). FOREST AND SHADE TREE INSECTS. The principles and methods of controlling insects which attack trees and forest products. Important species, their identification, biology and specific control measures. 2 class hours, 2 2-hour laboratory periods. Credit, 4. Mr. Becker.

279 (I). ANIMAL ECOLOGY.

Relations of animals to their physical and biotic environment, with observations and quantitative measurement of these factors and responses in the field and

laboratory. Prerequisite, a course in entomology or zoology. 2 class hours, 1 2-hour laboratory period.

Mr. Stoffolano.

290 (I), (II). EVOLUTION.

The course and dynamics of both inorganic and organic evolution. The implications of evolutionary concepts on human philosophy, behavior and welfare. Mr. Hanson.

355 (I), 356 (II). CLASSIFICATION OF INSECTS.

The identification of insects, including immature stages. First Semester: Orthoptera, Hemiptera, Coleoptera; Second Semester: other orders. Either semester may be elected independently. Given in alternate years. Prerequisite, permission of instructor; Entomology 126 desired. 3 2-hour laboratory periods. Staff.

357 (I). INSECT MORPHOLOGY.

The external anatomy of the major orders, with stress on phylogenetic relationships, as background for subsequent work in taxonomy and physiology. Given in alternate years. Prerequisite, permission of instructor; Entomology 126 desired. 1 class hour, 3 2-hour laboratory periods. Credit, 4. Mr. Hanson.

374 (II). MEDICAL AND VETERINARY ENTOMOLOGY.

Relationships of insects and their allies to the health of man and animals. The classification, biology and control of these pests. Given in alternate years. Prerequisite, Entomology 126 or permission of instructor. 1 class hour, 2 2-hour laboratory periods. Mr. Hall.

380 (II). INSECT CONTROL.

The science of pest control. Biological control and the need, economics, effectiveness, and hazards of insecticides are emphasized. Given in alternate years. Prerequisite, Entomology 126. 1 class hour, 2 2-hour laboratory periods. Mr. Lilly.

381. ECONOMIC ENTOMOLOGY.

Application of the principles of insect pest management with emphasis on past recognition, properties of available control agents and their correct use in planning control programs. Prerequisites, Entomology 126 or permission of instructor. Mr. Jensen.

382 (II). INSECT PHYSIOLOGY.

Detailed consideration of the organ systems, their functions in nutrition, reproduction, respiration, and growth, and the relationship of physiology to behavior. Given in alternate years. Prerequisites, Entomology 126 and permission of instructor. 2 class hours, 2 3-hour laboratory periods. Credit, 4. Mr. Edwards.

385, 386. SPECIAL PROBLEMS.

Individual study of a selected problem for qualified students. By arrangement with members of the department. Credit, 1-3.

Environmental Sciences

Commonwealth Professor Warren Litsky. Associate Professors Gunner, Mueller. Assistant Professor Walker.

201. INTRODUCTORY ENVIRONMENTAL BIOLOGY (E).

The response of the biota to environmental stress in-

duced by air, water and soil pollutants. Demonstrations, field trips. Prerequisites, Botany 101, Zoology 101 or equivalent. Staff.

285. MICROBIOLOGY OF THE SOIL.

(Also listed under Plant and Soil Sciences)

Soil microorganisms; their distribution, ecology and transformation of organic and inorganic substrates. Microbiology of the rhizosphere and the biological equilibrium. Prerequisites, Chemistry 111 & 112, or equivalent. 2 class hours, 1 3-hour laboratory period.

Credit, 3. Mr. Gunner.

303. AIR POLLUTION BIOLOGY.

A detailed description of the biological input used for the determination of air quality criteria, including the organism/environment interaction and dose/response phenomena in adapted and stressed systems. Staff.

385, 386. SPECIAL PROBLEMS.

Individual study of a selected problem for qualified students. By arrangement with members of the department.

Credit, 1-3.

Food and Agricultural Engineering

Head of Department: Professor J. T. Clayton. Associate Professors Fletcher, C. Johnson, Light, Norton, Whitney; Assistant Professors Chen, E. Johnson, Pira, Rha, Smith.

255 (I). AQUACULTURAL ENGINEERING.

Rate theory and similitude in the scale-up of biological processes. Case study of biological data used in the derivation of useful engineering system design relationships for the culture of mollusks. A bio-engineering comparison of several systems used in aquaculture. A field trip to inspect an aquacultural project in operation. Mr. Zahradnik.

261 (I). HOUSE PLANNING.

Space arrangement, construction materials, construction problems and discussion, utilities, financing, maintenance and remodeling. Emphasis on planning and evaluation procedures and factors. 1 class hour, 2 2-hour laboratory periods. Mr. C. Johnson.

281 (I). FUNDAMENTALS OF FOOD SERVICE SYSTEMS ENGINEERING.

The fundamental engineering principles involved in the planning, equipping and operation of a commercial restaurant. Emphasis on application of these principles to specific situations within the kitchen. 2 class hours, 1 2-hour laboratory period. Mr. Fletcher.

356 (I). CONTROL SYSTEMS FOR SOIL MOISTURE.

Design of systems for soil drainage and crop irrigation; soil requirements, climatology and hydraulics as applied to engineering problems involved in these systems. 2 class hours, 1 2-hour laboratory period. Mr. E. Johnson.

361 (I). STRUCTURES AND RELATED EQUIPMENT.

Fundamental aspects of planning modern farm structures; emphasis on design, environmental control and integration of mechanical equipment. 2 class hours, 1 2-hour laboratory period. Mr. Light.

365 (II). **PHYSIOLOGICAL UNIT OPERATIONS.** Introduction to physiological systems, studies of thermodynamics, fluid dynamics, heat transfer and mass transfer in biological systems, concepts in biological regulatory systems and biological engineering designs with specific examples. Prerequisites: Approval of department, or Chem. E. 256, or MAE 265 & 382.

Mrs. Rha.

375 (I). **FOOD PROCESSING SYSTEMS ANALYSIS.**

Continuous and batch processing systems for food and biological products, using flow analysis, systems analysis, scale-up, and simulation techniques. Analysis of machine operating principles, sanitary requirements, fabrication limitations and machine interrelations. Laboratory exercises in flow analysis, plant layout, and systems analysis of existing plant operations. Prerequisite, permission of instructor. 2 class hours, 1 3-hour laboratory period.

Mr. Whitney.

376 (I). **MECHANIZATION IN CROP PRODUCTION.**

Principles of operation, maintenance, and selection of farm tractors and field machinery; irrigation and drainage systems and equipment. Emphasis on management practices and discussions. 1 class hour, 2 2-hour laboratory periods.

Mr. Whitney.

381 (I). **ELEMENTS OF PROCESS ENGINEERING.**

Fundamental engineering principles involved in the processing of biological materials; emphasis on heat transfer, mass and energy balances, refrigeration, psychrometry, properties of fluids and fluid flow. 2 class hours, 1 2-hour laboratory period.

Mr. Fletcher.

384 (I). **UNIT OPERATIONS IN FOOD ENGINEERING.**

Application of engineering concepts to the processing and handling of biological materials, including evaporation, dehydration, irradiation, freeze drying, cost analysis, material handling, manual motion economy and packaging. 2 class hours, 1 2-hour laboratory period.

Mr. Fletcher.

385, 386. **SPECIAL PROBLEMS.**

Individual study of a selected problem for qualified students. By arrangement with members of the department.

Credit, 1-3.

390 (I). **INSTRUMENTATION.**

Instrumentation applied to research, covering recorders, indicators, controllers and transducers in general. Emphasis on applications and limitations. Prerequisite, Physics 104 or equivalent. 2 class hours, 1 2-hour laboratory period.

Mr. E. Johnson.

Food Science and Technology

Head of Department: Professor F. J. Francis. Professors Esselen, Fagerson, Hankinson, Hayes, Hultin, Navar, Stumbo; Associate Professors Buck, Levin, Potter, Sawyer; Assistant Professors Clydesdale, Evans, Hunting.

101 (II). **THE STRUGGLE FOR FOOD (E).**

Modern advances in science in the growth, production, and use of both natural and synthetic foods in alleviating the world food crises. Mr. Clydesdale, Mr. Francis.

251 (I). **INTRODUCTORY FOOD SCIENCE.**

Primarily for department majors. Food manufacture, preservation, processing, and distribution. Mr. Hayes.

258 (II). **ANIMAL PRODUCTS.**

Principles of processing, handling, packaging and storage of animal and other protein foods. Chemical and structural aspects of muscle as they relate to quality evaluation and preservation. 2 class hours, 1 2-hour lecture-demonstration.

Mr. Buck, Mr. Hayes.

275 (I), (II). **SURVEY OF FOOD TECHNOLOGY.** For non-Food Science and Technology majors. 2 class hours, 1 2-hour laboratory period.

Mr. Esselen, Mr. Hayes.

352 (II). **FOOD CHEMISTRY.**

The chemistry of food products. Chemical and biological changes in foods during storage and processing. Emphasis on changes at the cellular and molecular levels. Prerequisite, organic chemistry or concurrent registration.

Mr. Hultin.

361 (II). **FOOD PROCESSING.**

Introduction to the food industry, principles of processing and preservation in current usage. Statistical quality control procedures. 3 class hours, laboratories by arrangement.

Mr. Stumbo.

362 (I). **FOOD PROCESSING LABORATORY.**

Application and utilization of pilot plant equipment to study and evaluate principles of commercial practice in the food industry. Introduction to advanced techniques of food processing. 1 class hour, 1 4-hour laboratory period. Prerequisite, Food Science 361.

Mr. Stumbo.

365 (I). **UNIT OPERATIONS.**

Technical principles involved in the processing of food, milk and dairy products. 2 class hours, 1 2-hour laboratory period.

Mr. Hankinson.

366 (II). **QUALITY CONTROL AND STANDARDS.**

Relationship of composition, handling, processing, storage and market regulations to the bacteriological and chemical quality of milk and its products. 2 class hours, 2 2-hour laboratory periods.

Credit, 4. Mr. Evans, Mr. Potter.

371 (I). **ANALYSIS OF FOOD PRODUCTS.**

Physical, chemical, microbiological and microscopical methods. Prerequisite, Analytical Chemistry. 2 class hours, 1 4-hour laboratory period.

Mr. Hunting.

372 (II). **OBJECTIVE ANALYTICAL METHODS AND INSTRUMENTATION.**

Continuation of 371. Prerequisite, Food Science 371. 2 class hours, 1 4-hour laboratory period.

Mr. Hunting.

384 (II). **SENSORY EVALUATION METHODS.**

An introduction to sensory measurements in the evaluation and acceptance of foods. Panel tests and their statistical interpretations; taste, odor, color, and texture measurements. Methodology of consumer testing and statistical interpretation of data. For seniors only. 2 class hours, 1 2-hour laboratory period.

Credit, 2. Mr. Sawyer.

385, 386. **SPECIAL PROBLEMS.**

Individual study of a selected problem for qualified students. By arrangement with members of the department.

Credit, 1-3.

391 (I), 392 (II). **FOOD SCIENCE SEMINAR.**
For seniors who major in Food Science and Technology.
2 class hours. *Credit, 2.* Staff.

Forestry and Wildlife Management

Head of Department: Professor Arnold D. Rhodes.
Professors Abbott, Gatslick, MacConnell, Mader;
Associate Professors Bond, Carlozzi, C. F. Cole,
Dodge, Greeley, Hoadley, Larson, McCann, Reed,
Rice, Wetherbee; Assistant Professors Johnson,
Mawson, McNamara, Wilson; Instructor A. B. Cole.

FORESTRY

112 (I). DENDROLOGY.

The taxonomic features, silvical characteristics, and distribution of the principal tree species of temperate North America; a description of the forests where they occur. Prerequisite, Botany 100. 2 class hours, 2 2-hour laboratory periods. Mr. Abbott, Mr. A. B. Cole.

121 (II). TIMBER HARVESTING.

Timber harvesting and primary conversion of wood products. Mr. A. B. Cole.

222 (I) and Summer. CONSERVATION OF NATURAL RESOURCES.

Conservation principles and their application to problems in soils, water, forests, wildlife, mineral and general landscape resources; relationship of conservation to national development. Staff.

223 (I). SILVICS.

Forest ecology as a foundation for silviculture, watershed management, wildlife management, and forest recreation; environmental factors; development of trees and forest communities; forest influences. 3 class hours, 1 4-hour laboratory period.

Credit, 4. Mr. Mader, Mr. Wilson.

224 (II). FOREST SOILS.

Effects of soil properties on tree growth; relationship of soils to silviculture, harvesting, watersheds, wildlife, and forest recreation; forest soil description, classification, and mapping. 2 class hours, 1 4-hour laboratory period.

Mr. Mader.

225 (I) and Summer. THE ELEMENTS OF FOREST MENSURATION.

The measurement of trees, stands, and forest products; field-office practice in timber estimating and log scaling; collection and compilation of forest inventory data. 2 class hours, 1 4-hour laboratory period. Summer course, 3 40-hour weeks. Mr. Mawson, Mr. MacConnell.

226 (I). THE PRINCIPLES OF SILVICULTURE.

Culture of forest crops; regeneration and intermediate cuttings, silviculture, slash disposal; planting, direct seeding, nursery management; interactions with forest management for water, wildlife, and recreation. Prerequisite, Forestry 223 recommended. 3 class hours, 1 4-hour laboratory period. *Credit, 4.* Mr. Rhodes, Mr. Abbott.

227 (II). TREE PHYSIOLOGY.

Growth and development during the life cycle of trees, emphasizing the whole-plant approach and phenomena best studied in trees; the physiological basis of silviculture. Prerequisite, Botany 211 or equivalent. 2 class hours, 1 3-hour laboratory period. Mr. Wilson.

FORESTRY AND WILDLIFE MANAGEMENT

229 (II). FOREST PROTECTION.

Principles of protecting forests from fire, insects, disease, domestic animals, wildlife, and atmospheric agencies with special emphasis on the prevention and control of forest fires. Mr. Abbott.

231 (I). AERIAL PHOTOGRAMMETRY.

The application of photogrammetry in forest management, wildlife biology, and other fields concerned with large land surfaces; photographic interpretation and map making from aerial photographs. 2 class hours, 1 4-hour laboratory period.

Mr. MacConnell, Mr. Mawson.

232 (II). FOREST TREE IMPROVEMENT.

Tree introduction, geographic variation, tree selection, vegetative propagation, controlled pollination and hybridization, seed orchard management. Prerequisite, Forestry 112. 2 class hours, 1 4-hour laboratory period.

Mr. Abbott.

234 (II). ADVANCED FOREST MENSURATION.

The analysis of growth and yield in forest stands; construction of standard volume tables and yield tables; plotless cruising and continuous forest inventory. Prerequisite, Forestry 225. 2 class hours, 1 4-hour laboratory period.

Mr. Mawson.

235 (I). FORESTRY ECONOMICS.

The application of economic principles to the allocation of land, labor, and capital in forest enterprises; marketing and pricing theory of forest crops. Prerequisite, Economics 125. Mr. Bond.

236 (II). FOREST RESOURCES POLICY.

Forest policy in the United States: history of policy development; factors affecting forest resources management; forest taxation, credit, insurance, and resource planning. 2 class hours and 1 2-hour seminar. Mr. Bond.

239 (II). THE FOREST RESOURCES OF NORTH AMERICA.

The forest resources of North America and their management for multi-purpose economic and social benefits; regional physiography, climate, vegetation, demography, and economic base; environmental, economic, and socio-political constraints affecting management. Prerequisite, for seniors and graduate students with natural resource, regional planning, or similar backgrounds. Mr. Rhodes.

240 (II). PRINCIPLES OF FOREST MANAGEMENT.

Multiple-use management of forest land for wood, water, wildlife, and recreation; organization of the forest for sustained-yield management; preparation of management plans. Prerequisite for the laboratory, Forestry 225. 3 class hours, 1 4-hour laboratory period. Laboratory period optional for non-forestry majors.

Credit, 5 or 3 (lectures only).

Mr. MacConnell, Mr. Mawson.

302 (II). ECOLOGICAL PRINCIPLES OF RESOURCE PLANNING.

Analysis of ecological principles and their relationship and importance to resource planning. State and federal conservation programs chosen for critical case study. Prerequisite, permission of instructor. Mr. Carlozzi.

385, 386. SPECIAL PROBLEMS.

Individual study of a selected problem for qualified stu-

dents. By arrangement with members of the department.

Credit 1-3.

391 (I), 392 (II). FORESTRY SEMINAR.

Specialized study in a selected area of forestry. For seniors only. Staff.

WOOD TECHNOLOGY

201 (I). WOOD ANATOMY AND IDENTIFICATION.

A basic anatomical study of wood elements, their various structural characteristics and function; identification of woods. Prerequisite, Botany 100. 2 class hours, 1 3-hour laboratory period. Mr. Hoadley.

202 (II). PRIMARY TIMBER CONVERSION.

Survey of operations, principally sawmilling, in the primary conversion of logs into lumber and allied by-products; drying, grading, handling and market distribution of sawmill products. Not open to students in Forest Management except by special permission. 1 all-day field trip by arrangement. Mr. Rice.

203 (I). FOREST PRODUCTS.

A survey of the principal forest products, their manufacture and distribution. Mr. Gatslick.

204 (II). PROPERTIES OF WOOD.

The physical and mechanical properties of wood and their importance in wood utilization. Techniques for physical measurement and mechanical testing. Prerequisite, Wood Technology 201. 2 class hours, 1 3-hour laboratory period. Mr. Hoadley.

206 (II). WOOD MACHINING TECHNOLOGY.

Fundamental principles of knife and saw-tooth action as applied to problems of severing, surfacing, and shaping; general survey of commercial wood machining equipment. Prerequisites, Wood Technology 201 and 204. 2 class hours, 1 3-hour laboratory period. Mr. Rice.

208 (I). WOOD SEASONING AND PRESERVATION.

Properties of wood in relation to drying and preservation; theory and practice of air seasoning, kiln drying, and preservative treatment. Prerequisite, Wood Technology 204 recommended. 2 class hours, 1 3-hour laboratory period. Mr. Rice.

211 (I). WOOD ADHESIVE TECHNOLOGY.

Basic concepts, theories, and applied techniques of gluing wood and fibrous composites. Prerequisites, Wood Technology 201 and 204. Organic Chemistry recommended. 2 class hours, 1 3-hour laboratory. Mr. McNamara.

212 (II). WOOD COATING TECHNOLOGY

Basic concepts and applied techniques in wood substrate surface modification, including materials and methods for finishing wood and fibrous composites. Prerequisites, Wood Technology 201 and 204. Organic Chemistry recommended. 2 class hours, 1 3-hour laboratory period. Mr. Gatslick.

238 (II). WOOD CHEMISTRY.

Introduction to the chemistry and surface phenomena of the principal products found in wood. Prerequisite, Organic Chemistry. Mr. McNamara.

385, 386. SPECIAL PROBLEMS.

Individual study of a selected problem for qualified students. By arrangement with members of the department. *Credit, 1-3.*

391 (I), 392 (II). WOOD TECHNOLOGY SEMINAR.

Specialized study in a selected area of wood utilization and technology. For upperclassmen only. Staff.

WILDLIFE AND FISHERIES BIOLOGY

The first professional degree in Wildlife and Fisheries Biology is the master's degree; for this reason study toward the bachelor's degree should be regarded as a pre-professional program. Students who do not plan to enter graduate school are urged to meet with their advisers to select electives and plan their course of study accordingly.

WILDLIFE BIOLOGY

261 (I). PRINCIPLES OF WILDLIFE MANAGEMENT.

Fundamental ecology and principles of wildlife management. Emphasis on population characteristics and responses. 2 class hours, 1 4-hour laboratory period. Mr. Greeley.

262 (II). TECHNIQUES OF WILDLIFE MANAGEMENT.

Methods of collecting and interpreting data in wildlife management. Emphasis on field and laboratory experience in census methods and criteria for determining sex, age and other characteristics of wild birds and mammals. Prerequisite, elementary statistics. 2 class hours, 1 4-hour laboratory period. Mr. Larson.

263 (I). MANAGEMENT OF WETLAND WILDLIFE (1972-73).

Life histories, identification, and habitat requirements of waterfowl and marshland furbearing animals; management of wetland habitats. Prerequisites, Wildlife Biology 261 or elementary ecology. 2 class hours, 1 4-hour laboratory period. Mr. Larson.

264 (II). MANAGEMENT OF UPLAND WILDLIFE (1973-74).

Life histories, identification, and habitat requirements of upland game birds, game mammals, and furbearers; management of upland habitats. 2 class hours, 1 4-hour laboratory period. Mr. Greeley.

385, 386. SPECIAL PROBLEMS.

Individual study of a selected problem for qualified students. By arrangement with members of the department. *Credit, 1-3.*

391 (I), 392 (II). WILDLIFE SEMINAR.

Specialized study in a selected area of wildlife biology or management. For upper level students only. *Credit, 1-3.* Staff.

399 (I, II). SENIOR HONORS.

Credit, 6.

FISHERIES BIOLOGY

265 (I). TECHNIQUES OF FISHERIES BIOLOGY.

Principles and techniques of fishery management, stressing population and growth dynamics, and field procedures. Prerequisite, Zoology 300. 2 class hours, 1 4-hour laboratory. Mr. Johnson.

FORESTRY AND WILDLIFE MANAGEMENT

267 (I). **LABORATORY IN PRINCIPLES OF FISHERIES BIOLOGY.**

Field techniques in fisheries biology; operation and use of fishery research and management equipment. Laboratory analysis of field-collected data using automatic data processing; manuscript preparation. Concurrent enrollment in Fisheries Biology 265. 1 4-hour laboratory.

Credit, 1. Mr. Reed.

270 (II). **ECOLOGY OF FISHES.**

Biological responses of fishes to the environment. Asberg. Adjunct Professor Tabler; Associate Professor other responses to the environment will be considered. Prerequisites, Fisheries Biology 265 and Zoology 300 or permission of instructor.

Mr. Johnson.

272 (II). **INTRODUCTION TO MARINE FISHERIES.**

Factors affecting world marine fisheries resources and development. Review of selected species of commercial importance and selected world fisheries. Prerequisites, Fisheries Biology 265. 2 class hours, 1 4-hour laboratory. Several overnight field trips requiring Saturday attendance by arrangement; one oceanic field trip by arrangement. \$10.00 laboratory fee to defray travel expenses.

Mr. C. F. Cole.

385, 386. **SPECIAL PROBLEMS.**

Individual study of a selected problem for qualified students. By arrangement with members of the department.

Credit, 1-3.

391 (I), 392 (II). **FISHERIES SEMINAR.**

Specialized study in a selected area of fisheries biology. For upper level students only.

Credit, 1-3. Staff.

Hotel, Restaurant, and Travel Administration

Head of Department: Professor Donald E. Lundberg. Adjunct Professor Tabler; Associate Professors Cournoyer, Eshbach, Fletcher, Wisley. Lecturers Conrade, Egan, Grinnan, Robertson.

Students enrolled in the University or those expecting to transfer to the University and major in Hotel, Restaurant, and Travel Administration should take these courses:

FRESHMAN YEAR

First Semester

HRTA 100, Introduction
Rhetoric 100
Science Requirement
Math on basis of test results
Psychology 101 or Sociology 101

Second Semester

H & F 156, Food Prep. & Meal Planning
Rhetoric 110
Science Requirement
Statistics 121 or equivalent
Humanities Requirement

SOPHOMORE YEAR

First Semester

HRTA 102, Personnel Mgt. in Hotels & Restaurants
Econ. 125, Elements of Economics
Acctg. 125, Intro. to Acctg.
Humanities Requirement
Science Requirement
HRTA 203 – Guest Lecture Series

Second Semester

HRTA 367, Food Prep. & Science
Econ. 126, Problems of Nat'l Economy
Acctg. 100 or Comp. Sci. 121, Data Processing
Humanities Requirements

The following courses are included in the junior and senior years: Hotel Operations, Principles of Food Technology, Industrial Hygiene & Sanitation, Humanities Requirement, Food & Beverage Operations, Laws of Innkeeping, Corporation Finance, Food & Beverage Management, Food Service Facilities Planning, Seminars in Hotel & Restaurant Administration, Principles of Hotel & Restaurant Merchandising, and Food Production Management.

In cooperation with adviser, select two courses (beyond basic required) in one of the following areas: accounting, general business and finance, management or marketing.

All students are required to complete at least 800 hours of paid work experience in the hotel, restaurant or travel field – or 400 hours of paid work experience and completion of HRTA 310 and HRTA 311.

100 (I). **INTRODUCTORY HOTEL AND RESTAURANT OPERATIONS.**

The development of the industry, current trends, and an analysis of the various types of operations that make up the industry.

Mr. Lundberg.

101 (I). **FOOD SERVICE MANAGEMENT.**

Practices used by the food service industry pertaining to purchasing, receiving, and issuing food, beverages, and other supplies. Principles of food and beverage cost control.

Mr. Wisley.

102 (I). **PERSONNEL MANAGEMENT IN HOTELS AND RESTAURANTS.**

The management of people in food services and hotels; leadership and motivation, organization, training, job analysis, and work simplification.

Mr. Cournoyer.

200 (I). **HOTEL AND RESTAURANT ADMINISTRATION.**

Financial practices and systems used in hotels and restaurants. Controls, capital budgeting, operational budgeting, use and interpretation of financial statements, and specialized hotel accounting procedures. Non-majors must have permission of instructor.

Mr. Wisley.

201 (II). **LAWS OF INNKEEPING.**

Laws as applied to hotels and food service establishments; includes a consideration of bailments, torts, regulations, insurance and sanitation.

Mr. Cournoyer.

203, 204 (I). GUEST LECTURE SERIES.
Analysis of trends and practices as presented by leaders of the hotel, restaurant and travel field. *Credit 1.* Staff.

300 (I). HOTEL AND RESTAURANT
MERCHANDISING.

Market environment in which the firm operates; communication principles and their application to sales goals; the effective utilization of techniques and tools of merchandising in hotel, restaurant, and similar enterprises. Mr. Eshbach.

310 (I), (II). HOTEL SYSTEMS AND
OPERATIONS.

Analysis and evaluation of hotel systems and operations. Emphasis on analytical techniques, systems, computer-assisted operations, and change-induced problems. Opportunity to participate in operations of the Campus Center. 1 class hour, 2 2-hour laboratory periods. Mr. Grinnan.

311 (I), (II). FOOD AND BEVERAGE SYSTEMS
AND OPERATIONS.

Analysis and evaluation of food and beverage systems and operations. Emphasis on analytical techniques, systems, and operational decision-making within the food and beverage complex. Opportunity to participate in the food and beverage operations of the Campus Center. 1 class hour, 2 2-hour laboratory periods. Mr. Egan.

367 (II). FOOD PREPARATION AND SERVICE.
International cookery. Analysis of factors affecting the cooking process. The evaluation of new commercial equipment. 1 class hour. 1 4-hour laboratory period. Mr. Robertson.

385, 386. SPECIAL PROBLEMS.

Individual study of a selected problem for qualified students. By arrangement with members of the department. *Credit, 1-3.*

390 (I), 391 (II). SEMINAR.

Survey of current food service literature and reports. Outside speakers on selected professional topics. 2 class hours. *Credit, 2.* Staff.

Landscape Architecture and Regional Planning

Head of Department: Professor Ervin H. Zube.
Professors Bacon, Costley, King, Procopio, Scheffey; Associate Professors Carlozzi, Davis, Fabos, Greenbie, Hamilton, Kent, Mosher; Assistant Professors Cudnohufsky, Dines, Martin, Sears; Lecturers, Braun, Jarm, Olson, Schwarz.

ENVIRONMENTAL DESIGN

140 (II). VISUAL AWARENESS OF THE
PHYSICAL ENVIRONMENT (D).

A survey course intended to improve the ability to perceive, understand and discuss the physical/visual environment, its use and its problems. Concentrates on the breadth rather than the depth of environmental complexity, and deals with different environments, their component parts, processes and problems. Emphasizes an expanded consciousness of environment and a developed, directed and focused concern. Outlines or delimits

courses of citizen action. 2 class hours, 1 discussion period.

212 (II). GRAPHIC COMMUNICATION I.

The theories of projection as related to graphic communication. Prerequisite, Env. Des. 221. 1 class hour, 6 studio hours. *Credit, 4.*

221 (I). BASIC DESIGN.

Principles of 2 and 3 dimensional design and their relationship to the designed human environment. 4 2-hour studio periods. *Credit, 4.*

231 (I). PRINCIPLES OF ARBORICULTURE.

Maintenance of shade and ornamental trees. Development of municipal and private shade tree programs. 2 class hours, 1 2-hour laboratory period.

235 (I), 236 (II). PLANT MATERIALS.

Introduction to trees, shrubs and other plant material useful in landscape plantings. Prerequisite, Botany 100 or 101. 2 3-hour laboratory periods.

Credit, 3 per semester.

241 (I). HISTORY AND PHILOSOPHY
OF PARKS.

The historical, social and economic development of parks. Initial investigation of the philosophy of private, municipal, county, state and national parks.

243 (I). HISTORY AND THEORY.

A broad survey of the history of the designed human environment; from the origins of human society to the Renaissance.

244 (II). HISTORY AND THEORY.

A broad survey of the history of the designed human environment; the Renaissance to the present day. 2 class hours, 1 discussion period. Can be elected independently of 243.

263 (I). PARK ADMINISTRATION.

Analysis of park policies and procedures at the several governmental levels. 2 class hours, 1 2-hour laboratory period.

264 (II). PARK MANAGEMENT AND
OPERATION.

The principles and purposes of operational and maintenance practices. Selection and adaptability of maintenance equipment by field inspection. 2 class hours, 1 2-hour laboratory period. Field trip required.

273 (I). CITY PLANNING HISTORY.

The historical aspects of changing land uses, the evolution of community form and the development of urban areas.

274 (II). CITY PLANNING.

Planning techniques and legal tools for guidance and control of contemporary urban and metropolitan development. Special problems of land use, housing, transportation, and related urban elements. Can be elected independently.

315 (I). GRAPHIC COMMUNICATION II.

Current techniques used in the graphic communication of the analysis and solution of environmental design

problems; and the development of facility in the use of various media. Prerequisite, Env. Des. 212. 1 class hour, 6 studio hours. *Credit, 4.*

328 (II). APPLIED DESIGN.

The development of an approach embodying the application of theory and design principles to the solution of environmental design problems. Prerequisites, Env. Des. 347. 1 class hour, 6 studio hours. *Credit, 4.*

347 (I). THEORY.

Natural factors which influence environmental planning and site development. Influences of climate, land form, soil, water and vegetation. 2 class hours, 1 discussion period.

348 (II). THEORY.

Theories and techniques relevant to the analysis of design problems. Functional requirements. Consideration of human needs and responses to the designed environment. 2 class hours, 1 discussion period.

353 (I). LAND FORM.

Studies in the manipulation of land surfaces and its graphic representation through topographical plans, cross sections, profiles and models. Prerequisite, Env. Des. 212. 2 class hours, 1 2-hour laboratory period.

356 (II). CONSTRUCTION MATERIALS.

Study of the materials used in landscape construction, their design potential and limitations.

367 (I). PARK FISCAL AND PERSONNEL MANAGEMENT.

Evaluation of the methods utilized in the preparation, presentation and justification of the financial and personnel requirements of municipal, county, state and national parks.

368 (II). OPEN SPACE PLANNING AND DESIGN.

The relationship of open space planning to city and regional planning; the various functions of open space; the problems of planning and designing parks and recreation areas to satisfy varying needs. 2 class hours.

377 (I), 378 (II). URBAN PROBLEMS.

Nature of the planning function in government; and investigation of planning problems in housing, industrial location and development, decentralization of cities, urban transportation, urban design and regional planning. Prerequisite, Env. Des. 274. 2 class hours. *Credit, 2 per semester.*

385, 386. SPECIAL PROBLEMS.

Individual study of a selected problem for qualified students. By arrangement with members of the department. *Credit, 1-3.*

RELATED COURSE:

Recreation 361 (I). Introduction to Outdoor Recreation.

Plant Pathology

Head of Department: Professor Richard A. Rohde. Professors Banfield, Gilgut, Holmes, McKenzie; Associate Professor Agrios; Assistant Professor Mount.

PLANT PATHOLOGY / PLANT AND SOIL SCIENCES

251 (I). GENERAL PLANT PATHOLOGY.

The causes, nature and control of plant diseases. Mechanisms, biochemistry and genetics of plant disease induction, development and control. Prerequisite, a course in botany. 2 class hours, 1 3-hour laboratory period. Mr. Agrios.

269 (I). FOREST AND SHADE TREE PATHOLOGY.

The nature, cause and control of principal types of disease in trees, including decay of forest products, and of standing and structural timbers. 2 class hours, 1 3-hour laboratory period. Mr. Banfield.

361 (I). PLANT VIROLOGY (1972-73).

Structure and properties of plant viruses. Virus transmission. Virus infection and synthesis. Symptomatology and physiology of virus infected plants. Assay and purification of plant viruses. Identification and control of plant viruses. Prerequisite, Plant Pathology 251 or permission of instructor. *Credit, 4.* Mr. Agrios.

378 (I). NEMATOLOGY.

Anatomy, morphology, and classification of plant-parasitic and other soil-inhabiting nematodes, parasitic relationships with plants and principles of control. Alternates with 380. Prerequisite, a year of biological science. 3 class hours, 1 3-hour laboratory period. *Credit, 4.* Mr. Rohde.

380 (II). BIOLOGICAL TRANSMISSION OF PLANT DISEASES.

The intricate interrelationships between insects, plants, micro-organisms, and environment, in relation to the various roles played by arthropods and other life forms in the inception, transmission and perpetuation of plant diseases. Alternates with 378. Prerequisite, a year of biological science. Mr. Banfield.

385, 386. SPECIAL PROBLEMS.

Individual study of a selected problem for qualified students. By arrangement with members of the department. *Credit, 1-3.*

Plant and Soil Sciences

Head of Department: Professor F. W. Southwick. Professors Boicourt, Colby, Drake, Havis, Lachman, Lord, Thomson, Troll, Vengris, Weeks; Associate Professors Baker, Barker, Bramlage, Goddard, Gunner, Marsh, Maynard, Rosenau, Stewart, Zak; Assistant Professors Anderson, Greene, Jennings, Tuttle, Yegian.

100 (II). BASIC PLANT SCIENCE.

Some important structural features, physiological principles, and environmental factors related to the growth and development of economic crops. 2 class hours, 1 2-hour laboratory period. Mr. Jennings, Mr. Maynard.

105 (II). SOILS.

Fundamentals of soil science covering development, properties and management of soils and the interrelationship of soils to plant growth. 2 class hours, 1 2-hour laboratory period. *Credit, 3.* Mr. Zak.

110 (I). PLANT PROPAGATION.

The science of plant reproduction. 2 class hours, 1 2-hour laboratory period. *Credit*, 3. Mr. Goddard.

115 (II). THE PLANT ENVIRONMENT AND CROP PRODUCTION (E).

Important environmental factors affecting plant growth and development, the interrelationships which exist between these factors and plants, and the effects resulting from environmental modification attributable to man's activities. Mr. Rosenau, Mr. Jennings.

200 (I). DECIDUOUS ORCHARD SCIENCE.

The physiological and nutritional principles upon which deciduous tree fruit production is based. Responses of the plants to environmental influences and cultural practices. 2 class hours, 1 2-hour laboratory period.

Mr. Anderson.

205 (I). SMALL FRUIT TECHNOLOGY.

Basic principles underlying the production of small fruits. 2 class hours, 1 2-hour laboratory period.

Mr. Anderson.

210 (II). RETAIL FLORAL DESIGN.

Basic principles of design as applied to commercial floral arrangements. Non-majors excluded without special permission. 2 3-hour laboratory periods.

Mr. Boicourt.

215 (II). FLORICULTURAL SCIENCE.

The science and art of this phase of horticulture for non-majors. 2 class hours, 1 2-hour laboratory period.

Mr. Boicourt.

220 (II). PHYSIOLOGY OF GREENHOUSE CROPS.

Fundamentals of the artificial environment of greenhouses as they influence the vegetative and reproductive growth of plants. 2 class hours, 1 2-hour laboratory period.

Mr. Rosenau.

225 (I). PHYSIOLOGY OF VEGETABLE CROPS.

Factors influencing the growth and culture of vegetable plants. 2 class hours, 1 2-hour laboratory period.

Mr. Maynard.

230 (I). PLANT NUTRITION.

The accumulation and transport of inorganic ions in plants and their function in plant metabolism. 2 class hours, 1 2-hour laboratory period.

Mr. Maynard.

235 (I). TAXONOMY OF ECONOMIC PLANTS.

Plant families, genera, species and cultivars of importance in the horticultural and agronomic fields. 2 class hours, 1 2-hour laboratory period.

Mr. Boicourt.

240 (II). PLANT BREEDING.

Improvement of horticultural crops using established genetic principles and methods. Prerequisite, Zoology 240 or equivalent. 2 class hours, 1 2-hour laboratory period.

Mr. Lachman.

245 (II). POST-HARVEST PHYSIOLOGY.

The physical and chemical processes of plants before and after harvest and the influence of environmental, chemical, and storage factors on these processes. 2 class hours, 1 2-hour laboratory period.

Mr. Bramlage.

250 (II). FORAGE AND FIELD CROPS.

Analysis of the principles involved in the establishment, fertilization, and harvest management of forage and field crops. 2 class hours, 1 2-hour laboratory period.

Mr. Colby.

255 (I). AGROSTOLOGY.

The establishment and maintenance of turf grasses used on lawns, athletic fields, highways, airports, cemeteries and turf nurseries. 2 class hours, 1 2-hour laboratory period.

Mr. Troll.

260 (I). ECOLOGY AND CONTROL OF WEEDS.

Identification and ecology of common weeds and principles of weed control with emphasis on the use of chemical herbicides. 2 class hours, 1 2-hour laboratory period.

Mr. Vengris.

265 (I). SOIL FORMATION AND CLASSIFICATION.

The development and classification of soils as related to physical, chemical, biological, climatic and geological factors. 3 class hours, 1 2-hour laboratory period.

Credit, 4. Mr. Weeks.

270 (II). SOIL PHYSICS.

Physical properties of soils including water retention and movement, soil air and temperature microclimatology, soil texture and structure; their measurements, evaluation and influence in soil systems. Prerequisite, Plant and Soil Sci. 105, Physics 103-104 or their equivalents. 2 class hours, 1 3-hour laboratory period.

Mr. Stewart.

275 (I). SOIL CHEMISTRY.

The inorganic and organic chemical reactions related to the nutrient supply in soils and soil nutrition of plants. Colloidal aspects of soil chemical reactions and soil-plant mineral relationships. Prerequisites, Chem. 127 and Plant and Soil Sci. 265 or equivalents. 2 class hours, 1 3-hour laboratory period.

Mr. Baker.

280 (II). SOIL-PLANT MINERAL NUTRITION.

Mineral nutrition in the growth of plants; the use and interactions of fertilizers and other soil amendments; soil reaction; mineral deficiencies and toxicities in plants. 2 class hours, 1 2-hour laboratory period.

Mr. Drake.

285 (II). MICROBIOLOGY OF THE SOIL.

Soil microorganisms; their distribution, ecology and transformation of organic and inorganic substrates. Microbiology of the rhizosphere and the biological equilibrium. Prerequisite, Microbiol. 250 or permission of instructor. 2 class hours, 1 3-hour laboratory period.

Mr. Gunner.

385, 386. SPECIAL PROBLEMS.

Individual study of a selected problem for qualified students. By arrangement with members of the department.

Credit, 1-3.

390 (I). SEMINAR.

Review of literature in the plant and soil sciences.

Credit, 2. Mr. Maynard

Veterinary & Animal Sciences

Head of Department: Professor T. W. Fox. Professors D. Black, W. Black, Damon, Smith, Smyth; Associate Professors Anderson, Borton, Grover, Howe; Assistant Professors Denison, Duby, Lyford, Marcum.

The Department of Veterinary and Animal Sciences offers a program of study in the animal sciences. All students are expected to take Animal Science 121, 219, 220, 330, 334, 321, 308, 255 and

an animal management course; Zoology 240; and Microbiology 140. The curriculum provides for an important degree of flexibility depending upon the students' interests and ability.

Pre-veterinary students in the College of Agriculture major in animal science as freshmen. Students completing two semesters of academic work with a satisfactory cumulative average (2.5) may apply to the pre-medical advisory committee in their third semester for entrance into the pre-veterinary curriculum. Such students are counseled in the Department of Veterinary and Animal Sciences.

121 (I). INTRODUCTORY ANIMAL SCIENCE. Modern animal and poultry science and the many scientific disciplines it encompasses. The poultry, dairy, meat, recreational and laboratory animal industries in terms of national and world economics and their role in serving mankind. 2 class hours, 1 2-hour laboratory.

Mr. Borton.

150 (I, II). BEGINNING EQUITATION I.

Credit, 1. Staff.

151 (I, II). BEGINNING EQUITATION II.

Credit, 1. Staff.

152 (I, II). INTERMEDIATE EQUITATION I.

Credit, 1. Staff.

153 (I, II). INTERMEDIATE EQUITATION II.

Credit, 1. Staff.

154 (I, II). ADVANCED EQUITATION.

Credit, 1. Staff.

(150-154 also listed under Physical Education.)

219 (I). INTRODUCTORY ANIMAL PHYSIOLOGY.

Lays the foundation for the understanding and application of systematic organ physiology, through the presentation of homeostatic circuits available to the living body; such as fluid, gaseous, neural, muscular and specialized integrated mechanisms. Emphasis on application of physiological phenomena rather than factual memorization. 2 class hours, 1 2-hour laboratory.

Mr. Howe.

220 (II). SYSTEMIC ANIMAL PHYSIOLOGY.

A comparative study of the organ physiology of mammals and birds. Emphasis on those aspects most pertinent to animal science. 3 class hours, 1 3-hour laboratory.

Credit, 4. Mr. Howe.

256 (II). LIVESTOCK MANAGEMENT.

Beef, sheep and swine production in New England and the United States. Field trips cost \$5-\$10. 3 class hours, 1 2-hour laboratory.

Credit, 4. Mr. Borton.

308 (II). COMPARATIVE ANIMAL GENETICS.

The mechanisms of heredity and variation in livestock and poultry; the role of selection and breeding systems in genetic improvement and their evaluation. Prerequisite, Zool. 240.

Mr. Fox.

321 (I). PHYSIOLOGY OF REPRODUCTION.

Comparative aspects of anatomy, embryology, endocrinology and physiology of reproduction and lactation. 3 class hours, 1 2-hour laboratory period.

Credit, 4. Mr. W. Black.

330 (I). PRINCIPLES OF ANIMAL NUTRITION. Scientific principles of nutrition in both ruminants and nonruminants.

Mr. Anderson.

334 (II). APPLIED ANIMAL NUTRITION.

Application of scientific principles of nutrition to practical feed formulation and feeding systems for poultry and livestock. Prerequisite, Animal Science 330. 1 class hour, 2 2-hour laboratory periods.

Mr. Anderson.

353 (I). POULTRY MANAGEMENT.

Principles of poultry business management. A comprehensive view of all phases of the poultry industry. Field trips cost \$10-\$15. 2 class hours, 1 2-hour laboratory.

Mr. Grover.

354 (II). DAIRY HERD MANAGEMENT.

Dairy cattle and milk production in New England and the United States. Managerial problems concerned with successful dairying. Field trips cost \$10-\$15. 2 class hours, 2 2-hour laboratory periods.

Credit, 4. Mr. Duby.

358 (I). LIGHT HORSE MANAGEMENT.

An introduction to the breeds, feeding, training, care and management of the horse. Lab fee \$5-\$10 covers cost of field trips. Open to all University students. 1 class hour, 1 2-hour laboratory.

Credit, 2. Mr. Borton.

359 (II). LIGHT HORSE SCIENCE.

An advanced course in the nutrition, physiology, genetics, reproduction and health of the horse. Limited to Animal Science majors or by permission. Lab fee \$5-\$10. 2 class hours, 1 2-hour laboratory.

Mr. Borton.

361 (I). INTERMEDIATE BIOMETRY.

Emphasis on design of experiments conducted in the biological sciences. Methods of analysis of such designs, expectations of mean squares, selection of appropriate error terms, individual and multiple comparison, and trend analyses. Prerequisite, introductory course in biometrics, or statistics, such as Stat. 121.

Mr. Damon.

362 (II). ADVANCED BIOMETRY.

Analysis of data with disproportionate subclass numbers; includes the method of fitting constants, the method of weighted squares of means, absorption of equations, expectations of mean squares, and tests of hypotheses. Prerequisite, An. Sci. 361.

Mr. Damon.

370 (II). ANIMAL PATHOLOGY.

An introduction to the study of animal diseases. The causes, development, transmission and control, with application to diseases of animals which are of economic and/or public health importance. Prerequisites, Microbiol. 140 or Zool. 135 or An. Sci. 219.

Mr. Smith.

385, 386. SPECIAL PROBLEMS.

Individual study of a selected problem for qualified students. By arrangement with members of the department.

Credit, 1-3.

390 (I). JUNIOR SEMINAR.

Review of current literature in Animal Science.

Credit, 1. Staff.

391 (II). SENIOR SEMINAR.

Review of current literature in Animal Science.

Credit, 1. Staff.

Pre-Dental, Pre-Medical, Pre-Veterinary Program

Chief Adviser: Assistant Professor Benjamin C. Crooker, Department of Physics.

A pre-professional student should select a major department in the field of most interest to him. Requirements for professional schools can be completed within the four-year curriculum of most departments in the University. At the end of the first semester of his sophomore year, the interested student should apply to the pre-medical Advisory Committee for admission to the program as either an affiliate or a pre-professional major. Minimum preparation for pre-dental and pre-medical students is one year of inorganic, one year of organic,

and one semester of analytical chemistry; one semester of botany and one year of zoology; one year of college mathematics and one year of physics. Minimum requirements for pre-veterinary students are similar but they should include in their curriculum the specific courses Zoology 221, Zoology 240, Animal Science 121, Animal Science 330, Biochemistry 220, and Microbiology 250. Certain additional courses in biology, chemistry, or mathematics, as well as a foreign language may be required by some dental, medical, and veterinary schools. Students should consult their advisers as well as professional school catalogs in regard to specific requirements of particular schools. Persons interested in further information should contact the Pre-Med Office in Room 217, Hasbrouck Laboratory.

College of Arts and Sciences

Jeremiah M. Allen, *Dean, Faculty of Humanities and Fine Arts*

Dean Alfange, Jr., *Dean, Faculty of Social and Behavioral Sciences*

Mac V. Edds, Jr., *Dean, Faculty of Natural Sciences and Mathematics*

H. Duncan Rollason, Jr., *Associate Dean*

James W. Shaw, *Associate Dean*

Stephen I. Allen, *Assistant Dean*

George T. Sulzner, *Assistant Dean*

The College has programs of study leading to four bachelor's degrees: Bachelor of Arts, Bachelor of Science, Bachelor of Fine Arts, and Bachelor of Music. All departments offer a program leading to the B.A. degree. The B.S. degree may be earned only if the major is mathematics, natural science, or psychology. The B.F.A. programs have a strong emphasis in art and the B.Mus. programs reflect an emphasis in music. All of the degree programs combine a basic proficiency or experience in communication skills and a study in depth in one area with supporting study in the other two of the three main divisions: Fine Arts and Humanities, Social and Behavioral Sciences, and Natural Sciences and Mathematics. Courses appropriate to the communicative skills and distribution requirements in the three areas are noted in University Bulletins by the respective codes (B), (C), (D), and (E).

A program of study which conforms with the following eight provisions qualifies the student who completes it for the appropriate degree. Advanced placement and transfer credits may be applied toward any or all of these qualifications, but at least half of the major program must be completed in residence.

1. At least 120 credits (Core Requirement A).
2. Rhetoric (Core B): Two "B" courses required, one of which must be either Rhetoric 100 or 110.
3. Foreign Language: For the B.A. and B.S. degrees only, a basic proficiency or experience with foreign language must be demonstrated by (a) completion of a foreign language course at the 140 level, (b) satisfactory performance on an achievement or placement test, (c) four high school units in one foreign language or three units in one and two units in another foreign language, (d) a year in a high school in which English is not the basic language, (e) substitution of language-related study, if there is clearly demonstrated difficulty in language study, which has been approved by the Foreign Language Board. Note: 110, 120, 130 levels may be taken pass/fail.
4. Humanities and Fine Arts (Core C): Four "C" courses for B.A.; three "C" courses for B.S., B.F.A., B.Mus. (140-level "C" language courses may be used if language requirement is otherwise satisfied.)
5. Social and Behavioral Sciences (Core D): Four courses, three of which must be "D", for the B.A.; three "D" courses for B.S., B.F.A., and B.Mus.
6. Natural Sciences and/or Mathematics (Core E): Four "E" courses for B.A., B.S.; three "E" courses for B.F.A. and B.Mus.
7. For a B.S. degree, the major must be science, mathematics, or psychology and a minimum of 60 credits must be earned in these disciplines.
8. An approved major program must be completed.

W.E.B. DuBois Department of Afro-American Studies

Head of Department: Michael Thelwell; Associate Professors Cole, Lynch; Visiting Lecturer Lester; Assistant Professors Benjamin, Davis, Donaldson, Kaplan, Wiley; Instructors Austin, Miles, Smith, Terry; Lecturer Frame.

110, 120. ELEMENTARY SWAHILI.

Essentials of Swahili grammar and basic vocabulary. Elementary syntax and phonology. Genetic relationships between Swahili and other Bantu languages. Practice in reading and speaking Swahili. Sequence: Afro-Am. 110, 120, 130, 140. 3 class hours, 1 laboratory hour.

111. SURVEY OF AFRICAN ART.

An overview of the literature on African art and an analysis of both the theoretical basis for its study and of the distinguishing characteristics of its major traditions. An historical survey of Black art from prehistoric times (5000 B.C.) to the European arrival. Study of the neo-traditional art and the tourist trade.

130, 140. INTERMEDIATE SWAHILI.

(C designation on 140 level)

For students who have completed Afro-Am. 110, 120. More advanced study of grammar and idiom. Emphasizes conversation and readings in cultural and literary texts.

131. AFRICAN HISTORY (C).

The history of Africa including its natural environment, the development and basic characteristics of African culture, the major African civilizations from 300 A.D. to European penetration, the slave trade and its impact on African and European cultures, the use of colonialism, the development of movements for African independence, and finally the emergence of independent African states.

132. AFRO-AMERICAN HISTORY (C).

Begins with West African origins prior to the slave trade. The development, organization, practice, and consequence of slavery, and an historical survey of the American scene covering ten phases: beginning with the Revolutionary era and the paradox of slavery amidst the struggle for American political freedom, through the major issues and actions during the Civil War and Reconstruction to the politics of accommodation in the early twentieth century, ending with the origins of the Civil Rights movement and the present impasse in the search for an ideology. Covers all aspects of America's history from the standpoint of the Afro-American.

151. AFRO-AMERICAN LITERATURE AND ITS CULTURAL ROOTS (C).

The relevant forms of Black cultural expression contributing to the shape and character of contemporary Black Culture; the literary application of these in traditional Black writers. In four parts: (1) West African cultural patterns and the Black past; (2) the transition — slavery, the culture of survival; (3) the culture through the literature; and (4) Black perceptions vs. white perceptions.

152. BLACK RHETORIC (B).

Begins with the social and psychological implications of the adoption of English as a completely alien language. Traces development of the dialect, forms of expression necessitated by conditions of slavery; use of the Bible as a model for Black rhetoric; development of the sermon; evolution of the language of Black politics; and the use of satire as a means of communication.

161. INTRODUCTION TO POLITICAL SCIENCE — 20TH CENTURY (D).

The role of Black Americans in political theory and movements in the United States. Traces the development of Black political thought and organization up through the twentieth century, beginning with DuBois and including such movements as the Niagra and Garvey movements and Islamic Nationalism. The development of political institutions within the Black Community. Organizations of wide ranging political philosophies, from the National Association for the Advancement of Colored People to the Urban League and the Black Panthers.

211. AFRO-AMERICAN TEXTILE DESIGN AND FABRIC PRINTING.

The principle of design in the production of hand-printed textiles; designs will use motifs that reflect the Afro-American experience.

212. SCULPTURE: WELDED SHEETMETAL.

A basic and practical introduction to Black aesthetic and conceptual problems of Black sculpture. The theories on African art in relation to the Afro-American artist. The student is encouraged to find his or her own form of expression.

221. CULTURES OF WEST AFRICA (D).

A survey of the social, political, economic, and religious patterns of the traditional cultures of West Africa. The problems of continuity and change within these societies and their consequences.

222. THE BLACK CHURCH IN AMERICA.

The church as a continuing and powerful institution among Black Americans. The role of the church during different periods of history; functional interpretation of religion among Afro-Americans, and analysis of various types of Black churches.

223. AFRO-AMERICAN PEOPLE (D).

An analysis of the sub-culture of Black people in the United States. Definitions of Black culture, retention of Africanisms, language in relation to culture, the arts, the position of religion and the Black church, political movements and economic institutions as regards to Black culture.

231. LIFE AND WRITING OF W. E. B. DuBOIS.
An in-depth study of the life and works of W. E. B. DuBois, "Father of Pan-Africanism," and his influence on the political thought of Black Americans.

232. HISTORY OF BLACK NATIONALISM.

The examination of Black nationalism from the Nationalist Movement of the 1870s to the present.

233. AFRO-AMERICAN SLAVERY.

Examines several important questions concerning slavery in the United States with some comparisons with

slavery in Latin America. Identifies some important ideological forces which helped determine the character of the literature on the subject. Prerequisites, History 150-151, Afro-Am. 131-132, or permission of instructor.

251. **BLACK DRAMA (C).**

An investigation of the aesthetic and critical problems of Black drama, involving a close study of representative plays. The nature of the problem is whether white critics' judgments have not been too superficial and too motivated by a desire for the "primitive" and "simple" to allow that a Black writer could deal with universally human themes. The trends in current Black theater and a cursory look at contemporary street theater.

252. **BLACK IMAGES IN WHITE AMERICAN WRITING (C).**

A critical survey of white attitudes toward Blacks as reflected in the national literature from colonial times to the present.

253. **PRE-CIVIL WAR BLACK WRITINGS.**

Three novels, a play, significant poetry, autobiographies, appeals and defenses suggest the variety and range of Black expression and attitudes towards their cultural and social position as New World Africans between 1776 and 1866.

261. **REVOLUTION IN THE THIRD WORLD (D).**

The dynamics of what has come to be regarded as the "first modern socialist revolution" in Africa and the Arab world: The Algerian Revolution.

262. **WRITINGS OF FRANTZ FANON (D).**

Fanon's analysis of the function of violence within the general framework of political action; his search for identity and his redefinition of the concepts of negritude; his participation in the Nigerian Revolution and his indictment of the European Liberal Left, and his theory on the phenomenon of decolonization, the one-party system, and his definition of the Third World as a new internationale.

263. **PAN-AFRICANISM AND THE THIRD WORLD.**

A survey primarily of the history of Pan-Africanism through its roots in the West Indies to its manifestations in England, the United States, and the Conferencess of 1954. Also examines the politics of the "non-aligned" or neutralist countries under the leadership of such statesmen as Nehru, Tito, and Nasser, ending with an examination of the politics of the Third World Nation States.

264. **FOUNDATION OF BLACK EDUCATION IN THE UNITED STATES.**

A critical examination of the political, economic and social forces which have shaped the course of education for Black people in the United States from the reconstruction period to the present.

265. **SEMINAR IN BLACK CULTURE.**

An exploration of similarities and differences in the culture of Black folks in West Africa, the Caribbean and the United States. Following background lectures on African and Afro-American anthropology, each student makes a presentation based on comparative research on a selected aspect of Black culture. Prerequisites, Afro-Am. 121 and 122 or permission of instructor.

363, 364. **PAN-AFRICANISM (STRUGGLE FOR LIBERATION AND INDEPENDENCE).**

Offered for two semesters (one year) to analyze seriously the realities of the liberation struggle of African peoples. An in-depth examination of the writing of Pan-Africanists and a critical analysis of the revolutionary thrust toward independence and the unification of the African continent.

385, 386. **SPECIAL PROBLEMS.**

390, 391. **SEMINAR.**

Anthropology

Chairman of Department: Professor Richard B. Woodbury. Professors Fraser, Halpern; Associate Professors Hudson, Munn, Pi-Sunyer, Proulx, Salzmann, Workman; Assistant Professors Armelagos, Cole, Faulkingham, Fortier, Ingersoll, Wobst.

Anthropology majors must take Anthropology 104 and one other of the following introductory courses: 102, 103, or 105. They should also select three courses (two of which must be introductory) from the following social sciences: Sociology, Economics, Political Science and Psychology. All majors must elect a minimum of 30 credits in Anthropology, with at least 21 of these credits chosen from courses above the 100 level. The maximum acceptable credits in Anthropology is 36. Under special circumstances and with his adviser's approval, an Anthropology major may be allowed to substitute as part of this requirement up to nine credits of related Sociology courses, or non-duplicating courses in Anthropology given at another of the Five-College Cooperative institutions. It is strongly recommended that majors elect Zoology and Geology for partial fulfillment of their science requirements.

102 (I) or (II). **INTRODUCTION TO ARCHAEOLOGY (D).**

The history, methods and theory of archaeology, with an outline of the main characteristics of the prehistoric record throughout the world. 2 lecture meetings, 1 discussion and/or demonstration section.

103 (I). **INTRODUCTION TO PHYSICAL ANTHROPOLOGY.**

Human evolution, human variation, racial classifications, racism, and modern theories of variation.

104 (I), (II). **INTRODUCTION TO CULTURAL ANTHROPOLOGY (D).**

Social and cultural anthropology dealing with variations among societies in technology and economics, social and political organization, art, religion, and ideology.

105 (I). **INTRODUCTION TO LINGUISTIC ANTHROPOLOGY.**

Survey of the role and contributions of linguistics in anthropology. Biological foundations of language; the process of communication; language structure; linguistic ontogeny, phylogeny, and prehistory; the principle of linguistic relativity; and other topics.

220 (II). RESEARCH TECHNIQUES IN PHYSICAL ANTHROPOLOGY; SKELETAL ANALYSIS.

Methods for excavating and analyzing human skeletal material with emphasis on sexing and aging techniques. Problems in growth and development and in pathology. 2 2-hour labs.

234 (I). PRIMITIVE ART.

A survey of the cultural and aesthetic aspects of the visual arts of primitive societies in sub-Saharan Africa, Oceania, and North America. Emphasis on the function and meaning of art in society.

237 (I). PEOPLES OF MESOAMERICA (D).

A survey of the peoples and cultures of Mesoamerica from the earliest human habitation to contemporary national cultures. Major trends traced from pre-Cortesian times through the colonial period to independence. Prerequisite, Anthro. 104.

252 (II). RURAL AND PEASANT SOCIETIES (D).

Rural and peasant societies from the standpoint of their population and institutions, their emerging needs, and their relation to mass society. Prerequisite, Sociol. 101 or Anthro. 104.

255 (I). PRE-INDUSTRIAL TECHNOLOGY.

Analysis of selected aspects of the material culture of simpler societies, both past and present, in relation to social and economic aspects of culture. Prerequisite, Anthro. 102 or 104.

260 (II). PEOPLES OF EUROPE: EASTERN EUROPE AND THE U.S.S.R. (D).

A survey of the peoples and cultures of Eastern Europe; emphasis on the Slavic peoples as well as upon those cultures transitional between Europe, the Middle East and Asia from their prehistoric origins to the period of their modernization, stressing the role of peasantries and nomads with their changing ecological adaptations. Prerequisite, Anthro. 104.

261 (II). PEOPLES OF EUROPE: THE WESTERN MEDITERRANEAN (D).

A survey of the peoples and cultures of Mediterranean Western Europe. Emphasis on the historical span from the crystallization of distinct national cultures to the present.

263 (II). URBAN ANTHROPOLOGY.

Using as a point of departure the current urban condition, the origins and evolution of cities are explored in a cross-cultural framework. Emphasis on the nature of rural-urban relationships and how these have changed over time.

265 (II). PEOPLES OF EUROPE: CENTRAL EUROPE (D).

Anthropologically oriented examination of the culture of Central Europe, with particular emphasis on Czech culture: geographic, historical and demographic background; survey of folk culture and folklore; languages and beginnings of literary tradition; major developments in this century. Prerequisite, permission of instructor.

267 (I). PEOPLES OF EUROPE: ALPINE EUROPE.

Analysis of Alpine cultures from prehistoric through contemporary times. Cultural adaptation to environ-

mental variation in mountainous zones and the inter-relationship of mountain and lowland communities.

269 (I). CULTURES OF AUSTRALIA AND NEW GUINEA (D).

The ethnography of aboriginal Australia and New Guinea with emphasis on the particular problems of theory and analysis that have concerned anthropologists studying these areas. Prerequisite, Anthro. 104.

270 (II). CARIBBEAN CULTURES.

An ethnographic survey of the societies of the Greater and Lesser Antilles, emphasizing the interaction of European colonial and African cultures both historically and in respect to present economic and political problems.

315 (II). PRIMATE ANATOMY.

Structure and phylogeny of primates (prosimian, monkey and ape) with emphasis on evolutionary trends leading to man. Laboratory work provides experience in dissection. Prerequisites, Anthro. 103, Zool. 101 or equivalent. 2 class hours, 1 3-hour laboratory period.

320 (I). ECONOMIC ANTHROPOLOGY.

This course will survey the patterns of production, distribution and consumption in traditional societies as well as the social and political matrices of these patterns. Alternative theoretical approaches to selected problems in economic anthropology.

333 (I). KINSHIP AND SOCIAL ORGANIZATION.

A course designed to acquaint the student with basic conceptual tools and problems in this field. Principles of social organization such as kinship, descent, ranking, etc., examined with reference to individual societies and general theory.

335 (II). NATIVE AMERICAN LANGUAGES.

A survey of American Indian languages, primarily north of Mexico. Genetic classifications and Sapir's classification based on structural resemblances between language families. Type of linguistic structure and structural restatements. Comparative work and reconstructions. Prerequisite, Anthro. 105 or permission of instructor.

336 (II). POLITICAL ANTHROPOLOGY (D).

Anthropological approaches to the study of politics in representative bands, tribes, and states. Evaluation of several analytic stances through reading and discussing relevant political anthropological literature.

340 (I). RELIGION AND RITUAL (D).

Classical problems in the anthropology of religion from Durkheim and Tylor to Evans-Pritchard, Levi-Strauss and Lloyd Warner. Special attention to the analysis of ritual. Prerequisite, Anthro. 104 or permission of instructor.

362 (I). ORAL FOLKLORE IN NONLITERATE SOCIETIES.

Introduction to the ethnography of oral folklore. Topical emphasis on the analysis and function of tales; geographic analysis on Africa and North America.

364 (II). PROBLEMS IN ANTHROPOLOGY (D).
Examination of selected problems in physical anthropology, archaeology, social and cultural anthropology.

Illustrative material drawn from both non-literate and peasant societies. Prerequisite, Anthro. 104 or permission of instructor.

365 (I). WORLD ETHNOGRAPHY (D).

Selected societies of Africa, the Americas, Asia and Oceania. Problems of comparing societies, especially with regard to their environmental contexts and levels of productivity. Prerequisite, Anthro. 104 or permission of instructor.

366 (II). THE INDIVIDUAL AND SOCIETY (D).

Selected approaches to the interrelations of individual behavior and social patterns, with consideration of data on "Western" and "non-Western" societies. Prerequisite, Anthro. 104 or permission of instructor.

367 (II). CULTURES OF AFRICA (D).

An intensive survey of the cultures of Africa, a comparison of their social, political, religious, and economic patterns, and toward consideration of the evolution and interrelationship of the cultures of the area. Prerequisite, Anthro. 104 or permission of instructor.

368 (I). OLD WORLD PREHISTORY (D).

A survey of the prehistoric cultures of Europe, Asia, and Africa, with emphasis on the Paleolithic, Neolithic and early metal-using periods. Designed to give an understanding of the significant cultural developments in the Old World before the emergence of historic civilizations.

369 (I). NORTH AMERICAN
ARCHAEOLOGY (D).

An intensive survey of American Indian prehistory north of Mexico. Emphasizes the historical development processes in selected geographical regions. Prerequisite, Anthro. 102.

370 (II). NORTH AMERICAN INDIANS (D).

Indian tribes with various levels of technological development and social complexity, from areas north of Mexico, in terms of their environmental context and the impact of non-Indian societies on their cultures. Prerequisite, Anthro. 104.

371 (II). HUMAN EVOLUTION.

The mechanisms of evolutionary change, the fossil and archaeological evidence bearing on man's evolution, and an evaluation of the various interpretations of the evidence. Prerequisite, Anthro. 103.

373 (I). CULTURES OF SOUTHEAST ASIA (D).

An introduction to the history and ethnography of the native cultures of Southeast Asia, including consideration of the peasant populations and their expanding role in the development of modern Southeast Asian states. Prerequisite, Anthro. 104 or permission of instructor.

374 (II). CULTURES OF THE FAR EAST (D).

A survey of culture-history and ethnography of representative people of East Asia; peasant sub-cultures of traditional contemporary China, Japan, and Korea. Prerequisite, Anthro. 104 or permission of instructor.

375 (I). SOUTH AMERICAN
ARCHAEOLOGY (D).

A survey of the pre-Columbian cultures of South America and their development, with emphasis on the Andean areas.

376 (II). SOUTH AMERICAN ETHNOLOGY (D). An analysis of the colonial and contemporary cultures of South America with emphasis on Indian tribes. The interrelationship of Indian, European and Negro societies and their contributions stressed. Prerequisite, Anthro. 104 or permission of instructor.

377. SUMMER FIELD SCHOOL IN
ARCHAEOLOGY.

Practical experience and training in archaeology. Both prehistoric and colonial sites are excavated, and instruction given in archaeological methods and techniques. Prerequisite, Anthro. 102 or equivalent and permission of instructor. *Credit, 6.*

378 (II). THEORY AND METHOD IN
ARCHAEOLOGY (D).

An intensive examination into the scientific approach to modern archaeological research and the utilization of this approach for deriving and testing theories of prehistory and human behavioral patterns. Prerequisite, Anthro. 360 and permission of instructor.

379 (II). CULTURAL DYNAMICS AND
APPLIED ANTHROPOLOGY (D).

Theories of cultural process and their application to practical cross-cultural situations in administration, technical assistance and community development. Prerequisite, Anthro. 104 or permission of instructor.

380. FIELD COURSE IN CULTURAL
ANTHROPOLOGY.

A summer course affording the advanced undergraduate or graduate student supervised training in cultural anthropological research. Location varies from year to year. Prerequisites, advanced course work in Anthropology and permission of instructor. *Credit, 6.*

382 (II). HISTORY OF ARCHAEOLOGY.

Events, major sites, and men important in the development of archaeology during the 19th century and 20th century. Theoretical and technical advances related to the present state of archaeology emphasized. Prerequisite, Anthro. 102 and permission of instructor.

385, 386. SPECIAL PROBLEMS.

Individual study of a selected problem for qualified students. By arrangement with members of the department. *Credit, 1-3.*

388. READINGS IN ANTHROPOLOGY. *Credit, 1-3.*

389. READINGS IN ANTHROPOLOGY. *Credit, 1-3.*

Art

Chairman of Department: Professor George M. Wardlaw; Professors Becker, Benson, Kamys, Mallary, Norton, Perkins, Reed; Associate Professors Coughlin, Grillo, Matheson, Roskill, Roy, Townsend, Wang, Wozniak; Assistant Professors Berube, Cheney, Davies, Denny, Dube, Gongora, Hendricks, Kearns, Parks, Patterson, Poritz, Schleappi, Tarr, Wiedenhoef; Instructors Forwood, Mochon.

The three programs offered by the Art Department provide objectives ranging from a broad background of extensive coverage to highly specific

professional investigations. The Bachelor of Arts degree is designed to provide an historical and aesthetic knowledge of the arts while affording an opportunity to develop creative ability in the several media. The other two programs, both of a professional nature, lead to a Bachelor of Fine Arts degree. The B.F.A. degree program with a major in Art Education is specifically designed for prospective art teachers. The B.F.A. studio program enlists more intensive coverage of one chosen medium, ceramics, painting, printmaking, or sculpture, to be selected as a major by the student at the end of the sophomore year. While all three programs are subject to the University and College of Arts and Sciences Core requirements, the B.A. program commands a greater involvement of courses not directly within the Art Department. The B.F.A. program allows greater latitude of Core requirements for further concentration within the Art Department.

The B.A. degree program has three majors to choose from, Art History, Studio Art, and the Combination Major of both Studio Art and Art History. All B.A. majors require a minimum of 39 art credits, consisting of five elementary courses: Art 115, 100, 102, 120, and 122; (the combination Studio Art and Art History major may take Art 111 and 113 in lieu of Art 115 and Art 102); and eight upper division courses (numbered 200 or above), two of which must be Art History electives.

Art History is taught both as an adjunct to studio work, and as an area of the humanities tying in with the history, literature and philosophy of a given culture or period, and forming part of the history of ideas in general. Course offerings in the area are organized to provide three levels of instruction. (A) The Introductory Survey (100 level), (B) Area Courses (200 level) and (C) Seminars (300 level). The student consults with the faculty, especially in the last two years, to develop the sequential program best suited to the student's needs and interests. Directed undergraduate work, including the writing of an honors thesis, may be elected by qualified students.

Acceptance to either of the B.F.A. degree programs is effected during the sophomore year through the submission of a portfolio to a faculty selection committee. Admission is based on the criteria of demonstrated ability and high academic standing, giving these programs the flavor of honors work. Before acceptance, during the first two years, the student experiences a foundation program of several courses in drawing, two and three dimensional design, and the general history of art. Because of its contemporary nature and relevance, Modern Art should be taken as early as possible in the B.F.A. programs as a second Art History course.

The B.F.A. Art Education program, which is run in conjunction with the School of Education,

provides the student with the Massachusetts State Board of Education requirements for certification to teach art in the public school system at either the elementary or secondary level. The program's requirements include minima of 33 credits in Studio Art, 9 credits in Art History, 6 credits in Art Education, 15 credits for teacher certification (including 16 weeks of observation and student teaching in either elementary or secondary levels), and 51 credits of other academic disciplines. (Also to be taken early in the program are introductory courses in each major studio area.)

The B.F.A. Studio major program builds the best foundation for graduate study. It involves minima of 63 credits in Studio Art, 12 credits in Art History, and 48 credits in other disciplines (see College of Arts and Sciences requirements for B.F.A. degrees in Art). B.F.A. candidates will be reviewed by a committee of three faculty members from the specific major area at the end of the junior year. In the senior year a student may elect 6 - 12 credits in a degree project directed toward the exploration of personal objectives in the specific major area.

CREATIVE ART

100. BASIC DRAWING (C).

Drawing in black and white, applying pencil, crayon, charcoal techniques to representation in line and tone, emphasizing sound observation and effective presentation. 6 studio hours.

102. DRAWING COMPOSITION (C).

Continuation of Art 100. Emphasis on pictorial composition and advanced drawing techniques. 6 studio hours.

120. BASIC DESIGN I (C).

Two-dimensional design concepts arising out of work with specific problems in a variety of media. 6 studio hours.

122. BASIC DESIGN II (C).

Continuation of Art 120. Specific three-dimensional problems stressing the interrelationship of materials, processes, techniques, and sculptural concepts. Prerequisite, Art 120. 6 studio hours.

220. PAINTING I (C).

Easel painting in oil and related media, based on elementary understanding of physical properties of medium, and encouraging individual directions within limitation of sound composition. Prerequisites, Art 100, 120. 6 studio hours.

222. PAINTING II (C).

Initial concentration on transparent water color, emphasizing control of techniques and mastery of color relationships. Further experience with opaque water color, such as gouache, casein. Prerequisites, Art 100, 120. 6 studio hours.

224. PAINTING III.

Continuation of Art 220. Prerequisite, Art 220. 6 studio hours.

226. **PAINTING IV (Techniques and Materials).**
Advanced work in traditional and contemporary painting techniques and media. Includes encaustic, tempera, oil, oil-resin, acrylic polymer, synthetic media, grounds and supports. 6 studio hours. Prerequisite, Art 222, 224.

230. **ADVANCED DRAWING.**
Investigation and development of various techniques and media with special emphasis on figure drawing. Prerequisites, Art 100, 102. 6 studio hours.

232. **ADVANCED DRAWING PROBLEMS.**
Advanced work in traditional and contemporary drawing media. Independent exploration of graphic problems emphasized. Solutions to problems sought in relation to student's personal objectives. Prerequisite, Art 230. 6 studio hours.

240. **PRINTMAKING: RELIEF I (C).**
Basic study of material, technique, and aesthetic considerations peculiar to relief. Students print their own work. Prerequisites, Art 100, 120 or permission of instructor. 6 studio hours.

242. **PRINTMAKING: INTAGLIO I (C).**
Basic study of materials, techniques, and aesthetic considerations peculiar to etching, engraving, and aquatint. Students print their own work. Prerequisite, Art 100, 120, or permission of instructor. 6 studio hours.

244. **PRINTMAKING: LITHOGRAPHY I (C).**
Basic study of materials, techniques, and aesthetic considerations peculiar to lithography. Students print their own work. Prerequisites, Art 100, 120 or permission of instructor. 6 studio hours.

246. **PRINTMAKING: RELIEF II.**
Advanced study of materials, techniques, and aesthetic considerations relevant to relief printmaking. Students print their own work. 6 studio hours. Prerequisite, Art 240, 242, 244.

248. **ART EDUCATION: METHODS AND MATERIALS I.**
Methods, tools, and materials used in the public school art program, with emphasis on the elementary school level. 6 studio hours. Required for art education majors; prerequisite for student teaching.

250. **ART EDUCATION: METHODS AND MATERIALS II.**
The literature, philosophies, procedures, and methods used in the teaching of art, with emphasis on the secondary school program. Required for art education majors; prerequisite for student teaching.

254. **TYPOGRAPHY I.**
A studio course in typography and book design. The student selects a text, sets it in type, prints and binds at least one copy of the finished book. 6 studio hours.

260. **SCULPTURE I (C).**
Experimentation with materials. Investigation into the nature of 3-dimensional form. The development of 3-dimensional order. Individual projects. Prerequisites, Art 100, 122. 6 studio hours.

262. **SCULPTURE II (C).**
Continuation of Art 260. Prerequisite, Art 260. 6 studio hours.

264. **SCULPTURE III.**
A sequence of problems in direct and cast metal sculpture, using a variety of metals, techniques, and processes. Emphasizes traditional and modern foundry methods, and includes gas and electric welding. Prerequisite, Art 262 (previously or concurrently). 6 studio hours.

266. **SCULPTURE IV.**
Encourages development of a personal approach to sculpture and creative decisions. The student selects projects and materials of interest to himself and completes them within a classroom situation. 6 studio hours. Prerequisite, Art 264 (previously or concurrently).

280. **CERAMICS I (C).**
Involvement with form through the use of clay and related materials. Hand-building and work on the potter's wheel stress a creative, aesthetic approach and related ceramic history. Prerequisite, Art 100 or 120. 6 studio hours.

282. **CERAMICS II (C).**
Continuation of Art 280. Further refinement through hand-building and wheel techniques. Introduction to technology of clay, engobes, and firing. Prerequisite, Art 280. 6 studio hours.

284. **CERAMICS III.**
Creation of ceramic forms with stress on aesthetic principles rather than utility. Introduction to ceramic glaze technology and coloring media. Related ceramic history. Prerequisite, Art 282. 6 studio hours.

286. **CERAMICS IV.**
Continuation of Art 284. Emphasis on expressive potential of clay and glazes. Advanced techniques in glaze technology. Introduction to kiln design. Prerequisite, Art 284. 6 studio hours.

288. **GLASS BLOWING I.**
Basic principles and techniques of glass blowing from molten mixes, emphasizing experimental form. Prerequisite, Art 282 or permission of instructor. 6 studio hours.

290. **LIGHT WORKSHOP.**
Introduction to the use of light as a medium of aesthetic expression with emphasis on individual investigation into the techniques of modifying the quality of illumination. Prerequisites, three semesters in one of the following areas: painting, sculpture, ceramics, or printmaking. 6 studio hours.

320. **PAINTING V.**
Exploration of traditional and contemporary attitudes and approaches toward painting the human figure. Prerequisites, Art 224 and 226. 6 studio hours.

322. **PAINTING VI.**
Advanced work in painting composition with emphasis on independent exploration of painting problems and the development of effective personal forms of visual communication. Prerequisite, Art 224. 6 studio hours.

340. **PRINTMAKING: INTAGLIO II.**
Advanced study of materials, techniques, and aesthetic considerations relevant to etching, engraving, and aquatint. Students print their own work. Prerequisite, Art 240, 242, 244. 6 studio hours.

342. PRINTMAKING: LITHOGRAPHY II.

Advanced study of lithography, with emphasis on concepts and techniques of color lithography. Prerequisite, Art 240, 242, 244. 6 studio hours.

360. SCULPTURE V.

Advanced work in constructions and assemblage; formal and informal methods of composition, in a variety of materials and assembly techniques. Prerequisite, Art 266. 6 studio hours.

362. SCULPTURE VI.

Individual, collaborative and class projects of an advanced nature in new sculptural media such as plastics, light, and kinetics. Also inter-media projects involving the combination of sculpture with other arts such as painting, photography, architecture, urban design, music, dance, theater, etc. Prerequisite, Art 360 (previously or concurrently). 6 studio hours.

380. CERAMICS V.

Advanced exploration of ceramics and related media. Continued technology. Modern ceramic history. Emphasis on individual objectives. Prerequisite, Art 286. 6 studio hours.

382. CERAMICS VI.

Continuation of Art 380. Emphasis on personal interpretation of major contemporary problems in Ceramics. Prerequisite, Art 380. 6 studio hours.

385, 386. SPECIAL PROBLEMS.

Individual study of a selected problem for qualified students. By arrangement with members of the department. *Credit, 1-3.*

388. B.F.A. DEGREE PROJECT— CERAMICS, PAINTING, PRINTMAKING, AND SCULPTURE.

An independent advanced investigation and work pursued under the direction of a selected member of the faculty and designed to evolve a body of work mature in concept and individual in style. Specific requirements to be established by the director of the work. Independent studio work directed through frequent consultation with instructor. Prerequisite, Ceramics-Art 380, 382; Painting-Art 320, 322; Printmaking-Art 246, 340, 342; Sculpture-Art 360, 362.

ART HISTORY

111. SURVEY OF THE HISTORY OF ART:

EARLY CULTURES AND CIVILIZATIONS (C).
Art and architecture in the western world from the Palaeolithic era to the Gothic period.

113. SURVEY OF THE HISTORY OF ART:

RENAISSANCE TO MODERN (C).
Art and architecture in the western world from the Renaissance to the present time.

115. INTRODUCTION TO ART (C).

An introduction to great works of art studied in historical sequence, including techniques and aesthetic principles.

205. GREEK ART (C).

The sculpture, painting and architecture of Ancient Greece from Protogeometric beginnings to the end of the Hellenistic period. Students are encouraged to take Art 111 or Art 115 before this course.

ART

225. EARLY MEDIEVAL ART (C).

Early Christian art and the beginnings of Byzantine art in East and West; Coptic art, Barbarian and Celtic influences in northern Europe; Carolingian, Ottonian and Anglo-Saxon art.

227. ARTS OF THE ROMANESQUE AND GOTHIC PERIODS (C).

Art of the High Middle Ages: Romanesque and Gothic art with emphasis on architecture, monumental sculpture and painting in western Europe.

233. ISLAMIC ART AND ARCHITECTURE I (C).

Survey of the art and architecture of the Islamic peoples. Origins of Islamic art and institutions in the Near East, and its development throughout the Islamic world to the eve of the Mongol invasions in the thirteenth century.

235. ISLAMIC ART AND ARCHITECTURE II (C).

Survey of the art and architecture of the Islamic peoples, beginning in the thirteenth century. The art of the Mongols and Timurids in Iran and the Mamluks in Egypt, through the great Turkish, Iranian, and Indian Islamic cultures of the sixteenth century and beyond.

245. ITALIAN ART OF THE EARLY AND HIGH RENAISSANCE (1400-1520) (C).

The development of Italian art and architecture of the fifteenth and early sixteenth centuries in historical context.

247. ITALIAN ART OF THE LATE RENAISSANCE AND MANNERISM (C).

The dissolution of the High Renaissance; proto-Baroque and early Mannerist art; the courtly Mannerism of the revived feudal class after 1530; the artistic response to the Counter-Reformation. Prerequisite, Art 246 or permission of instructor.

255. BAROQUE ART AND ARCHITECTURE IN ITALY (C).

Art and architecture in Italy from 1600 to 1750, with emphasis on Rome. Students are encouraged to take Art 113 or 115 before this course.

261. THE ARTS OF AFRICA, OCEANIA, AND PRE-COLUMBIAN AMERICAS (C).

An introduction to the so-called "primitive arts" of traditional peoples of Africa, Oceania and pre-Columbian Americas.

263. AFRICAN ART (C).

A survey of ancient, traditional, and contemporary art and architecture of Western and Central Africa, with emphasis on art in its cultural context.

265. BAROQUE ART AND ARCHITECTURE IN NORTHERN EUROPE (C).

Art and architecture in France, Flanders, Holland, Germany, and Austria from 1600 to 1750. Students are encouraged to take Art 113 or 115 before this course.

271. ART OF INDIA (C).

The effect of the great Eastern religious movements on art in India and surrounding territories. Some attention to secular art and architecture in modern times.

273. THE HINDU TEMPLE (C).

The conception and development of the Hindu Temple in South and Southeast Asia, with emphasis on the structural traditions of the regions covered.

275. CHINESE PAINTING (C).

Shang tomb paintings, Han, Sung, Yuan, Ming and Ch'ing dynasty art, and the interplay between the art of Japan and the West.

277. ART OF BUDDHISM (C).

The development of Buddhist arts as they spread through Central Asia into East Asia and through Southeast Asia. The influence of the changing religion on the arts.

285. EUROPEAN ART, 1780-1880 (C).

Major developments in painting from David to Post-Impressionism in France, England, and Germany.

287. MODERN ART, 1880 TO THE PRESENT (C).

Major artists such as late Cezanne and Gauguin, Picasso, Matisse, Klee, Jackson Pollock, Optical and Pop artists. Main developments of style in relation to these artists.

291. 19TH CENTURY ARCHITECTURE (C).

Developments in the late 18th century, and history of changes in style, technical advances, and aesthetic principles during the 19th century in Europe and America.

293. 20TH CENTURY ARCHITECTURE (C).

Developments in modern architecture in Europe and America from 1900 to the present, including influential personalities, social and political influences, structural innovations, and aspects of city planning.

295. AMERICAN ART (C).

The earliest colonial art, the impact of later European influences, regional art of the 19th and 20th centuries, and contemporary developments.

305. ART OF EARLY MEDITERRANEAN CULTURES (C).

Brief consideration of Paleolithic-Neolithic background; emphasis on the high cultures of the Bronze Age; Egypt (and related Tigris-Euphrates lands); Minoan and Helladic; Hittite and derived. Also, Cyprus, Assyrian and Syro-Palestinian in first millennium. Prerequisite, Art 115 or permission of instructor.

325. MEDIEVAL PAINTING (C).

Early Christian murals and mosaics; Byzantine painting; early and later medieval painting in Western Europe; stylistic parallels in manuscript illumination and stained glass. Prerequisites, Art 111, 115, 225, 227 or permission of instructor.

363. SEMINAR ON AFRICAN ART (C).

Emphasis on methodology, authentication, and in-depth stylistic analysis of traditional African art. Prerequisite, Art 263 or permission of instructor.

365. ASPECTS OF NORTHERN EUROPEAN BAROQUE (C).

Selected aspects of Art or Architecture in France, Flanders, Holland, Germany, or Austria from 1600 to 1750. Treated in a combination lecture-seminar of limited size. Prerequisite, Art 255, 265 or permission of instructor.

371, 373. GREAT THEMES IN ART HISTORY (C). Central themes, issues, and problems of an important area in the history of art. Prerequisite, a survey level course bearing on the particular theme to be examined, or permission of instructor.

375, 377. MASTERS OF WESTERN ART (C).

Intensive study of the work of a master in the field of art. Permission of instructor. 1 or 2 class hours.

381, 383. METHODS OF ART HISTORY (C).

An introduction to the methods of study in this field, emphasizing different approaches to the work of art. Recommended for art history majors; open to other qualified students. Permission of instructor.

385, 386. SPECIAL PROBLEMS.

Individual study of a selected problem for qualified students. By arrangement with members of the department. *Credit, 1-3.*

391. ROMAN ART (C).

Origins and development of Roman architecture, portraiture, historical relief, painting and mosaics. Prerequisites, Art 115 or 205, or Ancient History or permission of instructor.

393. CRITICISM OF MODERN ART (SEMINAR).

Practical exercises in the evaluation of modern paintings. Discussion of the results.

397. ASPECTS OF AMERICAN ARCHITECTURE (C).

Selected aspects of the history of changes in style, technical advances, or aesthetic principles of architecture in the United States. Prerequisite, permission of instructor.

Asian Studies

Chairman of Program: Associate Professor William Naff. *Assistant Professor:*s Wang, Cohen. *Instructors:* Miller, Wang, Ozawa.

Although there is no major program in Asian Studies, the chairman will help students arrange a comprehensive and correlated series of courses dealing with the Far East. This provides an interdisciplinary approach, and at the same time permits flexibility in student programs.

CHINESE 126 (I), 127 (II). INTENSIVE ELEMENTARY CHINESE.

For those with no previous training in Chinese. Intensive practice in the language skills. 5 class hours, 2 laboratory periods. *Credit, 6.*

CHINESE 166 (I), 167 (II). INTENSIVE INTERMEDIATE CHINESE (C).

Development of skills in reading, writing, and speaking Chinese; emphasis on vocabulary, grammar, and syntax of modern Mandarin. 5 class hours. *Credit, 6.*

CHINESE 385 (I), 386 (II). ADVANCED CHINESE.

Extensive reading in modern Chinese; emphasis on speed and comprehension. Development in sentence analysis and vocabulary building. By arrangement. *Mr. Miller.*

ASIAN STUDIES

**JAPANESE 126 (I), 127 (II). INTENSIVE
ELEMENTARY JAPANESE.**

For those with no previous training in Japanese. Intensive practice in the language skills. 5 class hours. 2 laboratory periods. *Credit, 6.* Mr. Ozawa.

**JAPANESE 130 (I), 140 (II). INTERMEDIATE
JAPANESE (140:C).**

Development of written and spoken Japanese. 3 class hours, 2 laboratory hours. *Mr. Naff.*

**JAPANESE 260 (I), 261 (II). ADVANCED
JAPANESE.**

Development of vocabulary and reading speed in 20th century Japanese. Composition and classroom discussions in Japanese on reading material. Prerequisite, Japanese 127 or equivalent. *Mr. Naff.*

**150. THE DEVELOPMENT OF
MODERN ASIA (D).**

Problems of the nations of East and Southeast Asia created by the transition from traditional, pre-modern status to modern nationhood and full involvement in world affairs. *Mr. Maki.*

269 (I). INDIA AND SOUTH ASIA (D).

Recent political, economic, and social developments in India and countries of South and Southeast Asia. By permission may be counted for major credit in political science and sociology. Prerequisites, at least two semester courses in one or more of the following fields: economics, political science, sociology. *Mr. Driver.*

Biochemistry

Head of Department: Professor R. C. Fuller; Professors Little, Westhead; Associate Professors Gawienowski, Nordin, Robinson; Assistant Professors Fournier, Parsons.

The sample curriculum outlined below conforms to college requirements and closely follows recommendations made at the Symposium on Pre-graduate Education in Biochemistry held by the American Society of Biological Chemists in 1965.

First Year: Chemistry 113–114, Mathematics 123–124, Elementary Biology (I–II*), German 101–120, Rhetoric (I, II).

Second Year: Chemistry 165–166 or 261–262, Chemistry 167 or 263–264, Mathematics 173–174, Physics 141–142, German 130–140 and Humanities (I, II).

Third Year: Biochemistry 223–224; Biochemistry 225–226, Chemistry 210 (I)—Elementary Biological Science (II), Chemistry 281–282 or 285–286, Social Sciences (I, II) Humanities (I or II), Computer Science (II).

Fourth Year: Advanced Chemistry and/or Biology (I, II), 388 Introduction to Research (I, II), Social Science (I or II).

**120 (II). INTRODUCTION TO
BIOCHEMISTRY (E).**

A brief introduction to biochemistry as a terminal course for students whose professional objectives do not necessitate more extensive training in chemistry. Prerequisite, Chem 112. 3 class hours, 1 3-hour laboratory period. *Credit, 4.* Staff.

220 (I). ELEMENTARY BIOCHEMISTRY (E).
The more important facts relating to the chemistry of biological materials and processes. Designed primarily for students not eligible for Chemistry 223. Not open to chemistry majors. Prerequisite, Chem 160 or 261. 3 class hours, 1 3-hour laboratory period. *Credit, 4.* Mr. Nordin.

222 (II). GENERAL BIOCHEMISTRY (E).
A special section of Biochemistry 223 for students who may complete only one semester of biochemistry. Prerequisite, Chem 261 and 262 (concurrently). *Mr. Robinson.*

**223 (I), 224 (II). GENERAL
BIOCHEMISTRY (E).**

A broad introduction to the general field of biochemistry for students majoring in chemistry or in the biological sciences, and a background for more advanced or specialized study in this field. Prerequisites, Chem 166 or equivalent and Chem 281 for the second semester. Required of all biochemistry majors. *Mr. Little.*

**225 (I), 226 (II). GENERAL BIOCHEMISTRY
LABORATORY.**

For biochemistry majors and beginning graduate students in biological sciences. Lab material on laboratory techniques useful in solving problems in biochemical research. *Credit, 1 or 2.* Mr. Parsons.

385, 386. SPECIAL PROBLEMS.

Individual study of a selected problem for qualified students. By arrangement with members of the department. *Credit, 1–3.*

388 (I), (II). SENIOR SEMINAR.

Topics of current biochemical interest. *Credit, 1–3.*
*Selected from Botany, Microbiology, Zoology in any order.

Botany

Head of Department: Professor Otto L. Stein. Professors Bierhorst, Gentile, Livingston, Lockhart, Schuster, Shapiro, Smith, Swanson, Tipppo; Associate Professors H. Bigelow, Davis, Mulcahy, Rowley, Stern, Wilce; Assistant Professors Barrett, M. Bigelow, Fultz, Godfrey, Klekowski, Raudzens, Walker, Webster; Instructors Davis, Roberts; Herbarium Curator Ahles; Staff Associate Meyer.

Programs in Botany prepare students for teaching and research in biological sciences in high schools, universities, industry and experimental stations. Majors who expect to prepare for graduate training in Botany (other than that in preparation for secondary school teaching) must take:

Chemistry: 111–112

Chemistry: 261–262 or 160 and one of the following: Botany 212, Biochemistry 220, Physical Chemistry 281

Mathematics: Calculus 113 and one of the following: Stat. 231, Computer Sci. 131, Math. 112, or two semesters of Calculus (mathematics courses other than the second semester of calculus may be selected with the consent of the student adviser)

Physics: 141-142

Zoology: 240 (Genetics)

Foreign language: (See below)

Botany: 100 or 101 or 103, 211 (Physiology), 303 (Morphology, one semester), 221 or 222 (Ecology), 291 (Anatomy), 281 (Taxonomy), 311 (Cytology), 228 (Principles of Evolution)

Students are strongly encouraged to take a course in Microbiology (Microbiology 250 is preferred, but 140 is acceptable). Students who have had no high school Zoology or who believe their background in Zoology to be inadequate, should take Zoology 101. For the concentrate in Botany, knowledge of a foreign language is strongly recommended and German, Russian, French or Spanish, in that order, are preferred.

Students planning to teach in secondary schools taking a concentration in Botany must take the following courses:

Chemistry: 111-112, 160, Biochemistry 220 or Botany 212 or Physical Chemistry 281

Mathematics: 113 and one other math course

Physics: 141-142

Zoology: 101, 240 and one other zoology course with Zoology 101 as a prerequisite or Microbiology 140 or 250

Botany: 100 or 101 or 103, 125 (Plant Kingdom) or 303 (Morphology), 126 (New England Flora), 221 (Physiology), 228 (Principles of Evolution) and at least 9 additional credits in Junior-Senior botany courses

Additional requirements for certification are Psychology 263 or 301, and Education 251 in the junior year, and Education 285, 310, and 311 in one semester of the senior year.

100 (I), (II). **INTRODUCTORY BOTANY (E).**
Structure, function and reproduction of plants, dealing primarily with the flowering plants. Basic biological principles emphasized. Not to be taken serially with Botany 101. 3 class hours, 1 3-hour laboratory period.
Credit, 4. Mr. Klekowski, Mr. Walker, Staff.

101 (I), (II). **GENERAL BOTANY (E).**
An introduction to basic biological principles of organization, development and evolution, using botanical illustrations. The foundations and approach in biological research, and the consequence of this research on human thought and experience. Not open to science

majors without permission of major department. Not to be taken serially with Botany 100. 2 class hours; 1 demonstration-discussion hour. Staff.

121. **PLANTS AND ENVIRONMENT (E).**
The interrelationships between plants and their environment, emphasizing the impact of man's influence and control on the economy of natural biological areas. Designed for non-science majors. 2 class hours, 1 3-hour laboratory period. Not open to science majors without permission of major department. Mr. Livingston.

125. **THE PLANT KINGDOM (E).**
A general survey of the morphology, reproduction, distribution, and importance of the slime molds, bacteria, algae, fungi, lichens, liverworts, mosses, ferns and seed plants. Prerequisite, Botany 100 or 101. 2 class hours, 1 2-hour laboratory period.

Mr. Davis, Mr. Bigelow, Mrs. Bigelow.
126 (I), (II). **NEW ENGLAND FLORA (E).**
Identification of local flora (vascular) with emphasis on terminology of fruits, leaves, flowers, etc. Prerequisite, Botany 100 or 101. 2- and 3-hour laboratory periods with lecture combined. Several field trips.

Mr. Ahles.
175 (I). **GENETICS AND EVOLUTION (E).**
Survey of the cell and those fundamental genetic principles which are the basis of evolution. Origin and history of organic evolution. Mechanisms of evolution. Intended for non-science majors. Mr. Stein.

200. **NATURAL HISTORY (E).**
See Zoology 200.

211 (II). **INTRODUCTORY PLANT PHYSIOLOGY.**
Differentiation, growth, nutrition, and the communication between plant and environment used to illustrate the means by which plants function. Prerequisites, Botany 100 or 101, and at least one semester of Organic Chemistry. 3 class hours, 1 3-hour laboratory period.
Credit, 4. Mr. Rubinstein, Mr. Stern, Mr. Lockhart.

212 (I), (II). **PLANT METABOLISM.**
The chemical operation of plants, emphasizing the enzymatic processes involved in the synthesis and breakdown of the more important chemical constituents of plants. Prerequisites, Botany 211, Chem 160 or equivalent. 2 class hours, 1 4-hour laboratory period.
Credit, 4. Mr. Stern, Mr. Jennings, Mr. Marsh.

215. **PLANT GROWTH.**
The physiology, kinetics and energetics of plant growth. The growth of plant cells, whole plants, assemblages of plants, and plant productivity. Prerequisites, Botany 211, one year of introductory chemistry, and one year of introductory physics. Courses in differential calculus, statistics, and/or biochemistry are recommended.
Mr. Lockhart.

219. **ECOLOGICAL PLANT PHYSIOLOGY.**
Physiology of plants in relation to the classes of problems they face and the various strategies evolved for survival and growth. Prerequisite, Botany 211, one semester of differential calculus.

221 (I). **PLANT ECOLOGY.**
Interrelationships between plants and their environment, with emphasis on the structure and development

of plant communities. Prerequisite, Botany 100 or Botany 101; Botany 126 and 211 recommended. 2 3-hour class-laboratory periods.

Mr. Godfrey, Mr. Livingston, Mr. Mulcahy.

222. AUTECOLOGY.

Plant behavior in relation to the physical and biological environment, with emphasis on the ecology of individual plants. Prerequisites, Botany 211 and 221.

Mr. Godfrey, Mr. Livingston.

226. PLANT GEOGRAPHY.

Principles governing the development and natural distribution of plants and plant communities. Consideration of the vegetation of North America. Prerequisite, Botany 221; Botany 281 recommended.

Mr. Godfrey, Mr. Livingston.

228. PRINCIPLES OF EVOLUTION.

Ecological phenomena through the application of genetic concepts. The adaptation of individuals, populations, and communities as functional units. Prerequisite, Introductory Genetics or permission of instructor.

Mr. Mulcahy.

231 (II). MYCOLOGY.

Fungi, their life history and distribution, their significance in disease, their utilization by man. Prerequisite, Botany 125 or permission of instructor. 2 class hours, 1 3-hour laboratory period. Mr. Bigelow, Mrs. Bigelow.

240 (I), (II). PRINCIPLES OF GENETICS.

Mechanisms of heredity in plants and animals, emphasizing transmission and action of genes, population genetics, and evolution. Prerequisites, Botany 100 or Botany 101, Zool 101, Chem 112 or 114. Staff.

241 (I). PHYCOLOGY.

The phylogeny, taxonomy, morphology and ecology of the major group of the marine and fresh-water algae. Field work. 2 class hours, 1 2-hour laboratory period.

Mr. Wilce.

251 (II). THE ARCHEGONIATES.

The morphology, evolution and systematics of bryophytes, ferns and their allies. 2 class hours, 1 3-hour laboratory period.

Mr. Schuster.

255. EXPERIMENTAL PTERIDOLOGY.

Physiological and genetical parameters of the pteridophyte life cycle, integrated to give an overall biological view. The research potential of these organisms will be stressed. Prerequisites, Botany 240 or Zool 240, and Botany 211.

Mr. Klekowski.

261 (I). BIOLOGY OF LOWER PLANTS.

The use of fungi and algae as experimental organisms for investigations in physiology and genetics. Prerequisite, Botany 211, Zool 360, or Chem 224. 2 class hours, 2 3-hour laboratories.

Credit, 4. Miss Fultz.

270 (II). CYTOGENETICS.

Correlation of genetic data with the behavior of chromosomes, including an analysis of the mechanism of crossing over. Consideration of the evolution of chromosomal systems, including the following: genetic control of meiotic behavior, karyotype modifications, structural changes, sex-determining mechanisms, polyploidy, deviant meiotic behaviors, and primate systems. Prerequisites, Botany 311 and either Botany 240 or Zool 240.

Mr. Swanson.

280. ORIGIN, EVOLUTION, AND DISTRIBUTION OF FLOWERING PLANTS.

Survey of evolutionary history of primitive flowering plants and the significance of their geographic distribution. Prerequisite, Botany 125 or equivalent. Recommended, Botany 281, 291. 3 class hours, 1 2-hour seminar/discussion.

Credit, 4. Mr. Smith.

281 (II). INTRODUCTORY SYSTEMATICS.

The evolution and systematics of flowering plants, emphasizing families and their relationships. Prerequisite, Botany 100 or 101. 3 class hours, 1 3-hour laboratory period.

Credit, 4. Mr. Walker.

291 (I). PLANT ANATOMY AND HISTOLOGICAL METHODS.

Origin and structure of vegetative and reproductive organs of seed plants coordinated with exercises in preparation of stained slides for microscopic studies. Prerequisite, Botany 125 or permission of instructor. 2 class hours, 3 2-hour laboratory periods.

Credit, 4. Mr. Bierhorst.

301 (I). MORPHOGENESIS.

The development of plant form and structure at the level of cells and organs. Illustrations drawn from controlled experiments on the contribution of internal and external factors. 2 class hours, 1 3-hour laboratory-discussion period.

Mr. Stein.

303, 304. PLANT MORPHOLOGY.

The life cycles of various plant taxa, the dynamics of their evolution and the interpretation of various morphological structures. Prerequisite, Botany 100 or permission of instructor. 2 class hours, 2 2-hour laboratory periods.

Credit, 4. Mrs. Bigelow, Mr. Bierhorst,

Mr. Schuster, Mr. Wilce.

311 (I). CYTOLOGY.

Introduction to microscopy; nuclear duplication and division; nuclear function in cell development; structure, function and development of cellular membrane systems, with special reference to chloroplasts and mitochondria. 2 class hours, 1 2-hour laboratory period.

Mr. Webster.

335 (I). AQUATIC VASCULAR PLANTS.

Systematics, ecology and fundamental importance of aquatic plants. Designed for majors in Wildlife. Prerequisites, Botany 100, 126. 2 3-hour class-laboratory periods.

Credit, 1-3. Mr. Ahles.

385, 386. SPECIAL PROBLEMS.

Individual study of a selected problem for qualified students. By arrangement with members of the department.

Credit, 1-4.

387. NATURAL HISTORY OF MAN.

Man's changing view of himself as a result of scientific discoveries; his reorientation in space and time; his origin within the vertebrate group; his uniqueness as a species and as an individual, based on anatomical, cytological and genetic evidence; his biological antecedents which made the development of culture possible; and his future as an animal and a human being in an environment of finite capacity.

Mr. Swanson.

399. DEPARTMENTAL HONORS.

By arrangement.

Credit, 1-4. Staff.

Chemistry

Head of Department: Professor William E. McEwen. Professors Archer, Brandts, Cannon, Carpino, Chien, Holmes, Rausch, Ragle, Richason (Associate Head), Roberts, Siggia, Smith, Stein; Associate Professors Cade, Curran, George, Lillya, MacKnight, McWhorter, Miller, Rowell, Stengle, Stidham, Wood; Assistant Professors D. Barnes, R. Barnes, Chandler, Collins, Hixson, Oberlander, Olver, Rhodes, Uden, Williams, Wynne, Zajicek; Instructors Bernasconi, Reed, Turner.

Information on the chemistry curriculum may be obtained from Professor George Richason, the departmental Chief Adviser.

101 (I), 102 (II). GENERAL CHEMISTRY FOR NON-SCIENCE MAJORS (E).

The fundamental chemical laws and theories, as taught through the discussion of such topics as "Our Environment", "Energy Sources", "The Chemistry of Life", etc. Chem 102 is a continuation of Chem 101. The sequence does not satisfy the prerequisites for advanced chemistry courses. 2 class hours, 1 2-hour quiz-demonstration.

Mr. Richason, Staff.

110 (II). GENERAL CHEMISTRY (E).

The fundamental chemical laws and theories. Meets minimum prerequisite requirements of Chem 160 and Biochem 120 or 220. 2 class hours, 2 quiz hours, 1 2-hour laboratory period.

Credit, 4. Mr. Richason, Staff.

111 (I), 112 (II). GENERAL CHEMISTRY (E).

The fundamental chemical laws and theories. Provides a sound scientific training. For engineers and other students planning to take advanced courses in chemistry. 2 class hours, 1 quiz hour, 1 2-hour laboratory period.

Mr. Richason, Staff.

113 (I), 114 (II). GENERAL INORGANIC CHEMISTRY (E).

The fundamental chemical laws and theories, including the elements of qualitative analysis. For students planning to major in chemistry and others for whom the course is a departmental requirement. Prerequisite, secondary school chemistry. 2 class hours, 2 3-hour laboratory periods. *Credit, 4.* Mr. Richason and Staff.

127 (I), (II). ANALYTICAL CHEMISTRY (E).

The principles of analytical chemistry, for students not majoring in chemistry. Basic laboratory techniques and operations of quantitative analysis. Prerequisite, Chem 112 or 114. 2 lectures, 2 3-hour laboratory periods.

Credit, 4. Analytical Staff.

160 (I). ORGANIC CHEMISTRY (E).

For students whose major department does not require a year course in organic chemistry. Prerequisite, Chem 110 or 112. 3 class hours, 1 3-hour laboratory period.

Credit, 4. Organic Staff.

165 (I), 166 (II). ORGANIC CHEMISTRY FOR MAJORS (E).

261 (I), 262 (II). ORGANIC CHEMISTRY FOR NON-MAJORS (E).

Introduction to the chemistry of carbon compounds. Survey of the principal classes of organic compounds

and their reactions with emphasis on the relation between structure and reactivity. Prerequisite, Chem 112 or 114. Concurrent enrollment in Chem 167, 168 or 263, 264 required. Organic Staff.

167 (I), 168 (II). ORGANIC LAB FOR MAJORS.

263 (I), 264 (II). ORGANIC LAB FOR NON-MAJORS.

Application of the experimental techniques of organic chemistry to the preparation, purification and analysis of organic compounds. Concurrent enrollment in Chem 165, 166 or 261, 262 required. 1 3-hour laboratory period. *Credit, 1.* Organic Staff.

210 (I). QUANTITATIVE CHEMICAL ANALYSIS.

The principles and practices of titrimetric and gravimetric analysis; separation methods; introduction to physical methods. Primarily for chemistry majors and others needing more detailed treatment than given in Chem 127. Prerequisite, Chem 114 and 166. 2 lectures, 2 4-hour laboratory periods. *Credit, 4.* Analytical Staff.

213 (I). INSTRUMENTAL ANALYSIS.

The theory and practice of modern analyses utilizing optical, electrical, and thermal properties. Selected modern separation methods may also be included. Prerequisites, Chem 210, 286. 2 class hours, 1 4-hour laboratory period. Analytical Staff.

215 (II). THEORY OF ANALYTICAL PROCESSES.

A detailed consideration of analytical topics, such as chemical equilibrium, precipitate formation, chelating agents, multistage separation, etc., having general applicability in chemical investigations. Prerequisites, Chem 166 and 286. (Laboratory optional, 1 extra credit.)

Analytical Staff.

216 (I), (II). CHEMICAL MICROSCOPY.

Optics of the microscope, micrometry, microscopic study of fibers, crystals, physicochemical phenomena, qualitative analysis and an introduction to electron microscopy. Prerequisite, Chem 213 or permission of instructor. 2 3-hour laboratory periods.

Credit, 2. Mr. Roberts.

217 (I), (II). MICROQUANTITATIVE ANALYSIS. Quantitative determination of carbon, hydrogen, oxygen, nitrogen, sulfur, halogens and phosphorus. Both organic and inorganic compounds will be included in microgram scale analyses. Prerequisite, Chem 213 or permission of instructor. 1 4-hour laboratory period.

Credit, 1. Mr. Meade.

219 (I). ELECTRONICS INSTRUMENTATION FOR SCIENTISTS.

Laboratory oriented course designed for scientists which begins with electronic principles and leads through servo-systems, operational amplifiers, digital circuits, and other measurement devices. Prerequisite, one year of physics and permission of instructor. 1 class hour, 1 4-hour laboratory period. Mr. Curran.

244 (II). RADIOCHEMISTRY.

The character of atomic nuclei, nuclear reactions, radiation and its detection, and techniques for the study and utilization of radionuclides. Prerequisite, Chem 127 or 210, or permission of instructor. 3 class hours, 1 3-hour laboratory period. *Credit, 4.* Mr. Richason.

246 (I), (II). THEORETICAL INORGANIC CHEMISTRY.

A survey of theoretical aspects of inorganic chemistry. Topics include electronic structure and its relation to periodic properties, chemical bonding, molecular structure, coordination chemistry, acid-base theory, non-aqueous systems, and reaction mechanisms. Prerequisite, Chem 285. Inorganic Staff.

247 (II). INORGANIC CHEMISTRY OF THE COMMON ELEMENTS.

The common elements and their compounds; the periodic relationships and modern concepts of structure and bonding. An optional two-credit laboratory provides an introduction to inorganic laboratory techniques and practices. Prerequisite, Chem 246, or permission. 3 class hours (6 laboratory hours optional).

Credit, 3 (or 5). Inorganic Staff.

269 (II). ADVANCED ORGANIC CHEMISTRY LABORATORY.

Continuation of Chem 168. Preparations involving special techniques and use of the literature of organic chemistry. Prerequisite, Chem 166, 168. Limited to chemistry majors. 2 3-hour laboratory periods.

Credit, 2. Organic Staff.

271 (II). ADVANCED ORGANIC CHEMISTRY.

An intensive survey of aliphatic and aromatic chemistry with emphasis on scope and limitations of reactions; mechanisms, and recent developments. By permission of instructor. Prerequisite, one year of Organic Chemistry. Organic Staff.

272 (I). QUALITATIVE ORGANIC CHEMISTRY. Identification of unknowns, both single and mixtures of organic compounds, by physical properties, reactions and preparation of derivatives. By permission of instructor. Prerequisite, one year of Organic Chemistry. 2 class hours, 2 3-hour laboratory periods.

Credit, 4. Organic Staff.

281 (I). ELEMENTARY PHYSICAL CHEMISTRY. For students with a limited mathematical background. Not open to chemistry majors. Prerequisites, Chem 112 or 114; Physics 142; Math 124. Physical Staff.

282 (II). ELEMENTARY PHYSICAL CHEMISTRY. A continuation of Chem 281. 2 class hours, 1 3-hour laboratory period. Physical Staff.

285 (I), 286 (II). PHYSICAL CHEMISTRY.

The fundamental theories and laws of physical chemistry. Prerequisites, Math 174; Physics 142 or 162. Corequisites, Chem 210 or 127. Physical Staff.

287 (I), (II), 288 (I), (II). PHYSICAL CHEMISTRY LABORATORY.

Experience in modern physico-chemical techniques. Prerequisites, Chem 210; Math 174; Physics 142 or 162; or permission of instructor. Concurrent enrollment in Chem 285, 286. 1 4-hour laboratory period.

Credit, 2. Physical Staff.

290 (II). ADVANCED PHYSICAL CHEMISTRY.

A survey of modern physical chemistry with emphasis on the fundamentals of quantum mechanics and statistical mechanics. For students not taking further advanced work in these areas. Prerequisite, Chem 286. Physical Staff.

295 (I). ADVANCED PHYSICAL CHEMISTRY.

Topics such as chemical thermodynamics, statistical

mechanics, introductory quantum chemistry and theories of gases, liquids and solids. Prerequisite, Chem 286.

Physical Staff.

381 (I). CHEMICAL LITERATURE.

Intended to give facility in the location of information of a chemical nature. Prerequisites, Chem 166, 286, and a reading knowledge of German, or permission of instructor. 1 class hour. *Credit, 1.* Mr. Oberlander.

385, 386. SPECIAL PROBLEMS.

Individual study of a selected problem for qualified students. By arrangement with members of the department.

Credit, 1-3.

388 (II). INTRODUCTION TO RESEARCH.

Admission by permission of department. Each student assigned some special subject or problem in one of the several fields of chemistry. By arrangement. 10 laboratory hours. *Credit, 5.* Staff.

Related Courses

BIOCHEMISTRY 120 (II).

Introduction to Biochemistry.

BIOCHEMISTRY 220 (I).

Elementary Biochemistry.

BIOCHEMISTRY 223 (I), 224 (II).

General Biochemistry.

BIOCHEMISTRY 225 (I), 226 (II).

General Biochemistry Laboratory.

Classics

Head of Department: Associate Professor Gilbert Lawall; Professor Dyer; Associate Professors Cleary, Phinney; Assistant Professor Goar; Lecturers Baron, Reiner, Rustigian, Will.

Students majoring in Classics may place emphasis on Greek and/or Latin language and literature, ancient history, ancient art and archaeology, ancient philosophy, ancient religion and mythology, the Classical tradition, or a comparative study of ancient and modern literatures. Two or more of these fields may be combined according to the student's interests.

In addition to the courses listed below, various departments at the University offer courses dealing with specific aspects of classical antiquity. Consult the offerings in the Departments of Art, History, Philosophy, and Political Science.

LATIN

110. INTENSIVE ELEMENTARY LATIN.

An introduction to the elements of the Latin language. 3 class hours, 2 practice periods and optional laboratory sessions. *Credit, 4.*

112. INTENSIVE ELEMENTARY LATIN.

Same as Latin 110, above. This section is for students with no significant previous experience with Latin.

140. INTENSIVE INTERMEDIATE LATIN (C).

Mastery of the basic structures of the Latin language and attainment of intermediate competence in reading

CLASSICS

Latin prose. Prerequisites, Latin 110 or 2-3 years of secondary school Latin. 3 class hours, 2 practice periods and optional laboratory sessions. *Credit, 4.*

150. THE READING OF LATIN.

The development of increased competence in reading Latin prose. Prerequisites, Latin 140 or 4 years of secondary school Latin. 3 class hours, optional laboratory sessions.

160. THE READING OF LATIN (C).

Further development of reading competence; extended selections from Livy, Cicero, Sallust, and others. Prerequisite, Latin 150. 3 class hours plus optional laboratory sessions.

Latin 160 is prerequisite to all 200-level courses; with permission of instructor, students may go from Latin 150 to a 200-level course.

200. ADVANCED GRAMMAR AND STYLE.

An advanced study of the structure of the Latin language and of the evolution of grammatical and linguistic concepts and terminology used to describe it. Analysis of the style of representative Latin prose authors and exercises in composition in imitation of these authors.

205. ORAL INTERPRETATION OF LATIN LITERATURE.

Practice in the expressive reading of Latin texts. 1 class hour. *Credit, 1.* May be repeated up to 3 credits.

210. LATIN POETRY (C).

Selections from poets such as Catullus, Horace, Vergil, and Ovid. Prerequisite, Latin 160.

220. LATIN POETRY (C).

A continuation of Latin 210. Prerequisite, Latin 210. Latin 220 is prerequisite to all 300-level courses.

307. THE TEACHING OF LATIN IN SECONDARY SCHOOLS.

Examination and evaluation of various methods of teaching Latin in primary and secondary schools accompanied by actual experience teaching in the classroom and discussion of special problems. Class meetings: to be arranged. *Credit, 3-6.*

Two of the following upper level Latin courses (325-333) will be offered each semester. Latin 220 is prerequisite to any of these courses.

325. THE LATIN POLITICAL TRACT (C).

Selections from Sallust and Caesar accompanied by an historical and literary analysis of their works.

326. LATIN DIDACTIC EPIC (C).

Selections from Lucretius, Vergil's *Georgics*, Ovid's *Ars amatoria* and *Metamorphoses*.

327. LATIN HISTORY AND BIOGRAPHY (C).

Selections from Livy, Tacitus, and Suetonius.

328. LATIN DRAMA (C).

Selected plays of Plautus, Terence, and Seneca.

329. LATIN ESSAYS AND LETTERS (C).

The Roman mind as revealed in the philosophical works of Cicero and the moral epistles of Seneca; Roman private life and personal concerns as revealed in the letters of Cicero and Pliny.

330. LATIN ELEGIAC POETRY (C).

Selections from Catullus, Tibullus, Propertius, and Ovid.

331. CICERO'S ORATIONS (C).

The major orations of Cicero read and interpreted against their social and political background and analyzed according to ancient rhetorical theories.

332. LYRIC POETRY (C).

Selected lyrics of Catullus and Horace. The emergence of the Latin lyric as a literary form; the cultural and literary background of the poets, and some ancient and modern techniques of reading and understanding lyric poetry.

333. VERGIL'S AENEID (C).

The entire poem; traditional and contemporary critical perspectives and evaluations.

385, 386. SPECIAL PROBLEMS.

Individual study of a selected problem for qualified students. By arrangement with members of the department. *Credit, 1-3.*

390. LATIN SEMINAR.

Advanced study of some aspect of Latin literature. *Credit, 1-6.*

GREEK

110. INTENSIVE ELEMENTARY GREEK.

An introduction to the elements of the Greek language. 3 class hours, 2 practice periods and optional laboratory sessions. *Credit, 4.*

140. INTENSIVE INTERMEDIATE GREEK (C).

Mastery of the basic structures of the Greek language and attainment of intermediate competence in reading Greek prose. Prerequisite, Greek 110. 3 class hours, 2 practice periods and optional laboratory sessions. *Credit, 4.*

150. THE READING OF GREEK.

The development of increased competence in reading Greek prose. Prerequisite, Greek 140. 3 class hours plus optional laboratory sessions.

160. THE READING OF GREEK.

Further development of reading competence; extended selections from Greek prose authors. Prerequisite, Greek 150. 3 class hours, optional laboratory sessions.

210. GREEK POETRY.

Selections from Homer's *Iliad*. Prerequisite, Greek 160.

220. GREEK PROSE.

Selections from Herodotus. Prerequisite, Greek 210.

385, 386. SPECIAL PROBLEMS.

Individual study of a selected problem for qualified students. By arrangement with members of the department. *Credit, 1-3.*

CLASSICS

The following courses require no knowledge of Greek or Latin.

100. GREEK CIVILIZATION AND LITERATURE (C).

Ancient Greek culture and civilization: geography, politics, public and private life, mythology, religion, art, literary and philosophical viewpoints, science and technology. The impact of the Greek experience on the cultural life of the Western world.

102. ROMAN CIVILIZATION AND LITERATURE (C).

Ancient Roman culture and civilization: geography, politics, public and private life, religion, art, literary and philosophical viewpoints, science and technology. The impact of the Roman experience on the cultural life of the Western world.

105. GREEK AND LATIN ELEMENTS IN ENGLISH.

Historical survey of the induction of Greek and Latin words into English; Greek and Latin roots, prefixes, and suffixes which most often appear in the English language; patterns of changes in spelling and meaning; special problems. 2 class hours. *Credit, 2.*

225. MYTHOLOGY IN THE ANCIENT WORLD (C).

The structural affinities between Greek myth and earlier or contemporary myth from the ancient Near East, the influence of these traditional modes of mythic thought on the religions, society, and literature of Western civilization.

226. MYTHOLOGY IN ANCIENT ART (C).

The legendary cycles of Greek mythology and their Near-Eastern sources; the major deities and demons of Sumerian, Babylonian, Egyptian, Hittite, and Greek religions.

261. GREEK LITERATURE IN TRANSLATION (C).

Homer, lyric poetry, the major dramatists, selected dialogues of Plato, Herodotus, Thucydides, and their relations to the classical tradition.

262. LATIN LITERATURE IN TRANSLATION (C).

The development of Latin literature from Greek models; the emergence of uniquely Roman forms of comedy, tragedy, epic, lyric, pastoral, satire, history, biography, and novel; their influence on later literature.

265. GREEK DRAMA IN TRANSLATION (C).

Thematic analysis of selected Greek tragedies and comedies; typical characterization, cultural, political, and social values as expressed in the plays.

275. THEMES IN CLASSICAL LITERATURE (C).

A major theme in Classical literature, such as the hero or antihero, women, the individual and society, urban problems, the rise of science, or religion.

285. THE GREEK MIND (C).

The development of thought in the Greek world from Homer to Aristotle, tracing the evolution of mental concepts and ways of thinking about man and the world around him.

The following courses require a reading knowledge of Greek and/or Latin.

308. THE TEACHING OF CLASSICAL HUMANITIES IN SECONDARY SCHOOLS.

Guidance in preparing enrichment material in Latin language classes and in designing and teaching courses dealing with Classical life and institutions, drama, art, mythology, and literature in translation on the secondary school level.

385, 386. SPECIAL PROBLEMS.

Individual study of a selected problem for qualified students. By arrangement with members of the department. *Credit, 1-3.*

ARABIC

110-120. ELEMENTARY ARABIC.

An introduction to Modern Standard Arabic. 3 class hours, 1 or 2 laboratory periods.

130-140. INTERMEDIATE ARABIC (140:C).

Readings in Modern Standard and Classical Arabic.

ARMENIAN

110-120. ELEMENTARY ARMENIAN.

An introduction to the Armenian language. 3 class hours, 1 or 2 laboratory periods.

HEBREW

110-120. ELEMENTARY HEBREW.

For students with no previous training in Hebrew. Intensive practice in language skills. 3 class hours, 1 or 2 laboratory periods.

130-140. INTERMEDIATE HEBREW (140:C).

Emphasis on speaking and understanding; readings in cultural and literary texts.

Comparative Literature

Chairman of Department: Professor Warren Anderson. Professor Will; Associate Professor Beekman; Assistant Professors Lenson, Miller, Moebius, Plaszekiewicz-Pulc, Schroeder; Instructors Levine, Martin. Associated Faculty: Cassirer, S. Lawall, Mankin (French and Italian), Page (English), Schiffer (Germanic Languages).

The undergraduate major in Comparative Literature seeks to provide a more accurate sense of literary history than may be derived from the study of one single literature; it encourages detailed scrutiny of literary masterworks selected from more than one language, place, or time; and it embodies a variety of approaches to an understanding of the meaning and function of literature, considered both in itself and in its interdisciplinary dimensions.

Two different types of major program lead to the B.A. degree in Comparative Literature. One is designed for the student who plans to go on to graduate school in comparative literature or a closely allied field. The other is designed for the student who does not plan to go on to graduate

COMPARATIVE LITERATURE

school but wishes to read widely and deeply in two or more literatures during his undergraduate career. A detailed statement concerning these two programs and related requirements may be obtained at the Comparative Literature office.

101. THE FUNCTION OF LITERATURE IN OUR WORLD (C).

The art of literature in the face of other modes of cultural expression. Comparisons and contrasts drawn from contemporary cinematography, practical theater, music, and graphic art as well as from older works of art, both from the Occidental and the Oriental traditions.

201 (I), (II). MODERN EUROPEAN LITERATURE I (C).

The ways in which twentieth-century literature and philosophy have posed and answered questions about the human condition. The political and artistic consequences of the loss of tradition and community. The role of the arts in an age of technology and revolutionary ideology. Readings from Marx, Nietzsche, Malraux, Camus, Brecht, Artaud, and less well-known representative works of Italian literature.

202 (I), (II). MODERN EUROPEAN LITERATURE II (C).

Relationships between psychology and modern fiction, focusing on the concept of transformation; the possibilities for individual growth or metamorphosis; the development of the consciousness of the artist, as seen in the *Bildungsroman*, or "novel of development," and the *Künstlerroman*, or "artist novel." The modern use of myth, fantasy, and ritual as it underlines the role of the irrational in the creative process.

203 (I), (II). THE EUROPEAN NOVEL: MAN VERSUS SOCIETY (C).

French, Spanish, German, Russian, and English novels of the seventeenth to the twentieth centuries, in the context of the consciousness they reflect, describe, and transcend.

204 (I), (II). CLASSICS OF EUROPEAN LITERATURE (C).

Major works from the earlier literatures of Europe in English translation, with emphasis on a major genre such as the epic or drama. The interdependence of art and general culture, shown through lectures on religion, sociology, politics, and economics.

211 (I). EUROPEAN LITERATURE OF THE MIDDLE AGES I (C).

Medieval courtly romance and lyric in translation from French, German, Italian, and Middle English. Close analysis of texts; the literary, social, and psychological conventions of courtly poetry. The altered perspectives on those conventions expressed in late medieval poetry.

212 (II). EUROPEAN LITERATURE OF THE MIDDLE AGES II (C).

Medieval allegory and drama in translation from Latin, French, Italian, and Middle English. The development, from the early Christian period, of the allegorical tradition and of the dramatic tradition which evolved from it. The medieval imaginative conventions as expressed

in allegory, and the failure of those conventions in allegories and drama of the fourteenth century.

214 (II). DANTE, CHAUCER, AND SHAKESPEARE (C).

Dante's *Commedia*, several of Chaucer's *Canterbury Tales*, and several plays of Shakespeare. Close analysis of texts in their literary and historical contexts. The authors as representative of stages in the development of literary imagination which took place in European literature between the fourteenth and seventeenth centuries.

231 (I). MODERN AFRICAN LITERATURE (C).

An introduction to the modern literature of Africa south of the Sahara, examining such topics as the role of literature and the writer in an emergent country, the blending of Western and indigenous elements in a new literature, and the literary expression of color consciousness.

241 (I). THE CHINESE LITERARY TRADITION: CONTEMPORARY CHINA I (C).

An introduction to continuity and change in twentieth-century Chinese fiction, drama, and poetry, including both Communist and non-Communist literature of the Chinese mainland. The impact of Western literature on China and the resultant Chinese "Literary Renaissance." The relation between literature and politics in modern China. Special consideration of Chairman Mao Tse-tung's concept of literature as "Revolutionary Power" and of the role of the Red Guards in the Chinese Cultural Revolution. Reading in English translation includes Mao Tse-tung, Lu Hsun, Lao-she, Pa Chin, Mao Tun, Kuo Mo-jio, Shen Ts'ung-wen, Andre Malraux, and Pearl Buck.

242 (II). THE CHINESE LITERARY TRADITION: CLASSICAL CHINA II (C).

A general orientation in Chinese Classics from 600 B.C. to the end of the Sung dynasty (1279 A.D.). Selected readings, in English translation, of Confucian and Taoist literature and of the works of major Chinese poets. The role of Chinese verse and the Chinese written character in the development of Western poetry and cinema. Comparisons of the translations and "Chinese" poems of such writers as Ezra Pound, Ernest Fenollosa, Amy Lowell, Arthur Waley, and Gary Snyder.

243. JAPANESE LITERARY TRADITION I (C).

Japanese literature from 500 A.D. to 1600 A.D. Readings, in English translation, in court poetry, the *Tale of Genji*, the military tale, and the No theatre. The impact of Buddhism and of Chinese thought and literature on the course of Japanese literary development; the role of Zen in medieval Japanese esthetics, and early and medieval Japanese literature as an expression of Japanese civilization.

244. JAPANESE LITERARY TRADITION II (C).

Japanese literature from 1600 to the present. Linked verse and Haiku, the rise of popular theatre and fiction in the townsmen's culture in the seventeenth and eighteenth centuries. The modern novel (since 1885) and the interaction of Japanese and Western intellectual and artistic traditions. Novelists include Natsume Soseki, Tanizaki, Jun'ichiro, Kawabata Yasunari, and Mishima Yukio.

251. CHINESE LITERARY GENRES I: MYSTICAL LITERATURE EAST AND WEST (C).

Mystical literature written by contemplatives and monks of the Oriental (Buddhist-Taoist) and Occidental (Christian) monastic traditions. Comparisons between the imaginative presentation of concepts of reality, the self, and salvation in selected Eastern and Western prose and poetry. How mystics of different traditions perceive ultimate reality and how an approach may be made to such reality. Readings, in English translation, include representative works of Oriental and Occidental mystical literature.

252. CHINESE LITERARY GENRES II: VERNACULAR LITERATURE (C).

The development of Chinese fiction and drama from the medieval story-teller tradition through the modern period of literary symbolism. Chinese concepts of the novel and theatre; the reaction between erotic and allegoric literature in the evolution of Chinese society.

291 (II). MYTH AND LITERATURE (C).

The myths of creation and of self-development; emphasis on the literary treatment of mythical experience. Mythical trends and models identified in ancient literary texts and in very recent poetry and fiction.

321. RENAISSANCE PERSPECTIVES (C).

The tradition of the Middle Ages, the heritage of the Renaissance — the rhetoric of writing and the arts of reading and interpretation as handed down to the Renaissance. Examples and texts from English, French, Italian, and Latin may be read in translation. An easy reading knowledge of one of the following is required: Latin, Italian, French, Spanish, Portuguese, or German.

322. THE SHAPE OF THE RENAISSANCE (C).

Diversity and changes of literary style in the fifteenth and sixteenth centuries, with emphasis on cultural continuity, and with an examination of critical methods.

331 (I). THE ENLIGHTENMENT.

Characteristic themes, ideas, and attitudes in eighteenth-century European literature. Focus on major representatives of the Age of Reason such as Pope, Swift, and Johnson in England; Montesquieu, Voltaire, and Diderot in France; Wieland and Lessing in Germany.

341 (II). ROMANTICISM.

The Western Romantic movement as exemplified by its principal figures from the age of Rousseau to 1850.

342. POST-ROMANTIC TRENDS IN EUROPEAN LITERATURE (C).

Such developments as realism, naturalism, aestheticism, and neo-romanticism in the literatures of England, France, Germany, Poland, and Russia.

347 (I). LITERATURE AND MUSIC (C).

Relations between music and literature from Plato to Samuel Beckett. The aesthetics of Schopenhauer and the synthesis of Wagner are taken as the crux of a modern problem of meaning and structure in both literature and music.

351. SYMBOLISM (C).

The development of symbolism during the nineteenth and twentieth centuries as seen in the poetry of France (Baudelaire, Verlaine, Mallarmé, Rimbaud), Germany

(George, Hofmannsthal, Rilke), and England (Yeats, Pound, Eliot).

352 (I). MODERN DRAMA (C).

Currents in Western drama since Ibsen, with emphasis symbolism, neo-romanticism, expressionism, folk drama and fantasy, epic realism, and the "grotesque" and on one or more of the following topics: naturalism, "absurd" theatre.

361 (II). THE CONTEMPORARY EUROPEAN NOVEL (C).

Commitment and innovation in the modern novel. Among authors considered are Proust, Gide, Camus, Mann, Hesse, Kafka, and the Bloomsbury Group.

371. EUROPEAN EPIC POETRY (C).

Literary analysis of major classical and Renaissance epics (by Homer, Vergil, Dante, Milton) and three related heroic poems ("Gilgamesh," "Beowulf," "Chanson de Roland"), with emphasis on their intrinsic qualities as works of art. Specific epic techniques and the general epic tradition related to other genres and literary problems; examination of the sources of many later patterns and themes.

375 (II). ANGLO-GERMAN LITERARY RELATIONSHIPS SINCE 1750 (C).

Subjects and problems common to English and German literature since the middle of the eighteenth century; some attention to German-American literary relationships. May be counted for major credit in English and German by permission.

380. THEORIES OF LITERATURE (C).

Problem-oriented discussion. Students compare and employ some of the main critical theories in Western literary history. Initial discussion of the students' own approaches to literature; subsequently, several areas of literary analysis (e.g., formalism, expressionism, historicism) considered against a background of literary and critical texts ranging from Plato to contemporary authors. Prerequisites, three upper-division courses in literature, of which one must be in a language other than English.

385, 386. SPECIAL PROBLEMS.

Individual study of a selected problem for qualified students. By arrangement with members of the department.
Credit, 1-3.

Economics

Head of Department: Professor Simon Rottenberg, Professors Barkin, Howard, Kindahl, Morris (on leave), Smith, Sonnenschein; Associate Professors Blackman, Eagly, Holesovsky; Assistant Professors Aitken, Best, Burghardt, Cox, Ehrenberg, Gale, Gunderson, Mirman, Ray, Treyz, Tsao, Wright; Visiting Assistant Professors Cole, Kihlstrom; Instructors Chandran, Duston, Gordon, Kane, Zachariasz.

Students planning to take one or two economics courses will normally choose courses with numbers in the one hundreds. Those students who plan to take several economics courses will normally take Economics 103 (formerly 126) and then take

courses in the two or three hundreds for which they have the required prerequisites.

Economics majors must take Economics 103, and 104, (University approval pending), 203 (formerly 201), 204 (formerly 214) and at least 12 additional credits from the economics curriculum. All majors are required to take one mathematics course containing calculus (113, 116, 123 or 153). Normally economics majors will not take more than two courses with numbers in the one hundreds. No more than three such courses will be credited toward the major. Students contemplating graduate study in economics or business administration are advised to take mathematics at least through introductory calculus, linear algebra (Mathematics 115) and two semesters of statistics (preferably Statistics 315 and 316).

With the exception of Economics 103 and 104, *declared Economics majors* may not elect any Economics Department course on a pass-fail basis, nor may the required credits in mathematics be elected on a pass-fail basis. Students who become economics majors *after* previously passing one or more upper-division economics courses on a pass-fail basis must offer at least six *graded* upper-division economics courses (18 credits) for graduation.

100 (I), (II). ELEMENTS OF ECONOMICS (D). A one-semester introduction to economics. The elements of the discipline; how the economy is structured and how it functions.

103 (I), (II). INTRODUCTION TO MICROECONOMICS (D).

Introductory analysis of resource allocation and income distribution through microeconomic theory. Specific problems illustrate the use of the theoretical precepts developed.

105 (I), (II). HONORS SECTION OF ECONOMICS 103 (D).

Permission of instructor.

Mr. Treyz.

121 (I). THE INTERNATIONAL ECONOMY (D). An historical and analytical introduction to international institutions, trade, finance and policy. Current problems and recent developments treated extensively.

Mr. Aitken.

131 (II). THE ECONOMICS OF INSECURITY AND POVERTY (D).

Public and private programs to prevent or alleviate economic insecurity, including poverty, substandard incomes and economic contingencies. Mr. Blackman.

141 (I). LABOR PROBLEMS (D).

Background of the labor movement and problems involved in the management-labor relationship and the efforts of management, unions and government to solve them. Mr. Blackman.

172 (II). THE SOVIET ECONOMY (D).

Resource allocation through centralized planning in the Soviet economic system. A case history of economic development. Current problems of economic reform.

Mr. Wright, Mr. Holesovsky.

181 (II). ECONOMICS AND URBAN PROBLEMS (D).

The structure of the urban economy; goals, processes, problems and policy in urban economic development. Mr. Duston.

203 (I), (II). INTERMEDIATE

MICROECONOMIC THEORY (D).

Microeconomic analysis of consumers, firms, industries, and markets; rational decision-making under conditions of certainty; balancing forces in a free enterprise economy. Prerequisite, Econ 103.

204 (I), (II). INTERMEDIATE

MACROECONOMIC THEORY (D).

Formulation and empirical testing of static and dynamic theories of aggregative income, employment, and prices with reference to fluctuations, growth, and economic forecasting. Prerequisites, Econ 103 and 104.

211 (I). MONEY AND BANKING (D).

The development and operation of the monetary and banking systems of the United States; problems of achieving full employment and price stability through monetary controls. Prerequisite, Econ 104. Staff.

212 (II). MONEY, INCOME AND MONETARY POLICY (D).

The relationships among money, income and monetary policy, and among individuals, banks, money markets, governments and central banks. Prerequisites, either Econ 211 or Finance 210. Staff.

231 (I), (II). SOCIAL CONTROL OF BUSINESS (D).

The formal and informal methods and efforts to maintain, supplement and moderate competition, and the substitution of regulation and public enterprises for competition. Prerequisite, Econ 103. Mr. Howard.

232 (I), (II). THE STRUCTURE OF AMERICAN INDUSTRY (D).

Business enterprise, market competition, and economic development in American industries. The social effectiveness of industries analyzed through measures of industrial structure and market performance. Prerequisite, Econ 103 recommended, 203.

Mr. Gale, Mr. Gordon.

242 (II). LABOR LAW AND LEGISLATION (D). Economic effects and historical survey of Federal and state laws and an analysis of important court decisions. Prerequisites, Econ 141, or permission of instructor.

Mr. Blackman.

251 (I), (II). MATHEMATICAL METHODS IN ECONOMICS.

The applications of various mathematical concepts and techniques in macroeconomic and microeconomic analysis. Emphasis on the design and interpretation of mathematical models of economic phenomena. Prerequisites, Econ 103, Math 111, 112, or permission of instructor. Mr. Sonnenschein.

252 (II). ECONOMETRICS.

The application of mathematical and statistical methods to economic theory, applied to both microeconomic and macroeconomic policy issues. Permission of instructor.

261 (I). EUROPEAN ECONOMIC EVOLUTION (D).

Evolution of economic organization in agriculture, industry and commerce; the surrounding social and institutional life. Prerequisites, History 100 and 101, or an economics course. Mr. Eagly.

262 (II). AMERICAN ECONOMIC HISTORY (D).
An analytical approach to structural change, economic growth, and the development of market institutions in the United States from colonial times to the present. Prerequisite, Econ 100 or 103. Mr. Gunderson.

266 (I). ECONOMIC DEVELOPMENT (D).
Economic problems of underdeveloped countries and the policies necessary to induce growth. Individual projects required. Prerequisite, Econ 100 or 103 or 104.

267 (II). LATIN AMERICAN ECONOMIC DEVELOPMENT (D).
Development of the Latin American economies. Emphasis on the central problems of the various economies and proposed economic programs. Prerequisite, Econ 266 or permission of instructor. Mr. Best.

271 (I). COMPARATIVE ECONOMIC SYSTEMS (D).
Evaluation of the performance of alternative economic systems in theory and practice. Problems of planning in the advanced economies of the United States, Western Europe, and Soviet area. Prerequisite, Econ 103. Mr. Wright, Mr. Holesovsky.

281 (I). REGIONAL ECONOMICS (D).
The process of regional economic growth; location theory and basic techniques of regional analysis; public and private area development programs. Prerequisite, Econ 103 recommended, 203. Mr. Kane.

301 (I). DECISION THEORY IN ECONOMICS (D).
The modern theory of rational decision-making under conditions of uncertainty, risk, and conflict. Applications to the theory of the firm and the theory of oligopoly. Prerequisites, Econ 103, one year of college mathematics, or permission of instructor.

306 (I). DEVELOPMENT OF ECONOMIC THOUGHT (D).
The evolution of contemporary theory from its classical beginnings; neoclassicism and its chief variants; dissenters Marx, German historical school, Veblen. Emphasis on relation of economic thought to other kinds of social theories. Prerequisite, Econ 103. Mr. Eagly.

312 (I). PUBLIC FINANCE (D).
Principles of public revenues and expenditures; systems and problems of taxation; use of taxes, expenditures, debt policy to provide full employment; economic growth and price stability. Prerequisite, Econ 103 and 104. Mr. Cox, Mr. Ray.

314 (II). STATE AND LOCAL PUBLIC FINANCE (D).
State and local government revenue and expenditure programs. Individual research projects relating to Massachusetts or surrounding states required. Prerequisites, Econ 100 or 103. Mr. Ray.

ENGLISH

322 (II). INTERNATIONAL TRADE AND ECONOMIC POLICY (D).
Intermediate theory of international trade, including the analysis of the balance of payments mechanism, pure non-monetary theory and its application to problems of commercial policy. Prerequisites, Econ 203 and 321. Mr. Aitken.

345 (I), (II). HUMAN RESOURCE ECONOMICS (D).
An economic analysis of private and social means for providing access to higher education, housing, medical care and an improved environment. Poverty, population concentration, and discrimination as barriers to the achievement of these ends. Policies and priorities in human resource development. Prerequisite, Econ 103 or equivalent. Mr. Duston.

372 (I). NATIONAL ECONOMIC POLICIES OF ADVANCED EUROPEAN COUNTRIES AND PROGRAMS.
Evaluation of the economic objectives, instruments, measures and results of economic policy and decision-making mechanisms in the United States, in comparison with Norway, Sweden, Netherlands, United Kingdom and Canada and such other advanced non-socialist countries as the students may select. Prerequisite, Econ 103 and 104. Mr. Barkin.

385, 386. SPECIAL PROBLEMS.
Individual study of a selected problem for qualified students. By arrangement with members of the department. Credit, 1-3.

391 (I), 392 (II). SEMINAR.
Research in economic theory, problems of labor, commerce, and industry. If desirable, some other economic study may be substituted. Prerequisite, Econ 103. 1 or 2 2-hour conferences. Credit, 1-3.

Related Courses:

AGRICULTURAL AND FOOD ECONOMICS
352. Agricultural Policy.
373. Resource and Conservation Economics.
381. International Agricultural Development.

English

Head of Department: Professor Joseph Frank. Professor and Acting Dean, College of Arts and Sciences, Jeremiah Allen; Professors Barnard, Brogan, Campbell, Chametzky, Clark, Copeland, Creed, Emerson, Golden, Haven, Helming, Kaplan, Koehler, Langland, Lesser, Mayer, Mitchell, Musgrave, O'Donnell, Page, Plumstead, B. Spivack, Swados, Varley, M. Wolff; Part-time Professor Hoopes; Associate Professor and Associate Head of Department Hofer; Associate Professors Bagge, Barron, Berlin, Carey, Cheney, Clayton, Donohue, Fetler, Gallo, Horrigan, Junkins, Kinney, Levitt, Mariani, McCarthy, Noland, Porter, Raymond, Saagpakki, Sanders, Tucker, Turner, Ziff; Part-time Associate Professor C. Spivack; Assistant Professors Aho, Ashton, Beaty, Bell, Cameron, Carson, Collins,

Diamond, Edwards, Eidsvik, Emmart, Freeman, Gozzi, Harrington, Hogan, J. A. Hunt, Jayne, Jenkins, Jorgens, Kahn, Keefe, Leheny, Lowance, Lyons, Matlack, Mewshaw, Moran, Nelson, Neugeboren, Paroissien, Quick, Quigley, Reed, Shadoian, Sitter, Swaim, Tate, Teunissen, C. Wolff; Part-time Assistant Professor B. Hunt; Instructors Adams, Current, DiMarco, DuBois, Farrell, Grahame, Louis, Robinson, C. K. Smith, E. Smith; Part-time Instructor P. Edwards; Part-time Lecturers P. Allan, Alspach, Gat, Kenseth; Associate Dean Shaw.

The English Department offers courses in the study of English and American literature, courses in the relationship between literature and other disciplines and art forms, and courses in creative and expository writing. Innovative and experimental courses are taught under the rubrics of English 390-391 and 380-384. Descriptions of these courses are available shortly before pre-registration at the English Department Undergraduate Studies office in Bartlett 252.

The English major will normally take between 30 and 45 hours of upper-class English courses. Among these courses he will normally take 1) a course in the literature of a period before 1800; 2) a course in non-English literature (the department recommends English 125); and three of the following four options: i) one course in the study of a genre such as tragedy, comedy, satire, lyric poetry, or prose fiction; ii) one course in the study of a single British or American author; iii) one course in the study of the English language; iv) one course in the works of Shakespeare. A list of particular courses that fulfill these requirements may be picked up at the Department's Undergraduate Studies Office.

The English major is encouraged to work within the flexible framework of the major to create for himself a coherent program of study. The Department offers concentrations within the major, such as American Studies, Journalistic Studies, Literature and Psychology, and the Renaissance; other concentrations can be designed. The Department's main advisers keep regular office hours to help the undergraduate plan his program.

125 (I), (II), 126 (I), (II). MASTERPIECES OF WESTERN LITERATURE (C).

Selected masterpieces, from Homer and the Bible to James Joyce or Robert Frost. Aims to enrich appreciation of literary values and develop understanding of abiding human issues.

131 (I), (II). SOCIETY AND LITERATURE (C). Literature that deals with man's relationship to society. Topics may include: the utopian vision; the notion of the self; politics and literature. Readings may include works by Mailer, Sophocles, Austen, Thoreau, Marx.

135 (I), (II), 136 (I), (II). MASTERPIECES OF WESTERN LITERATURE (C).

The same as 125, 126 as to content and credit, but conducted in weekly evening sessions to facilitate the discussion method.

141 (I), (II). MAN AND WOMAN IN LITERATURE (C).

Literature treating the relationship between man and woman. Topics may include the nature of love, the image of the hero and of the heroine, and definitions, past and present, of the masculine and the feminine. Readings may include works by Lawrence, Freud, Shakespeare, Cummings, Homer, the Brontës.

152 (I), (II). READING FICTION (C).

An introduction to themes and techniques of fiction through a reading of selected short stories and novels with emphasis on such matters as structure, style, point of view, and the like.

153 (I), (II). READING POETRY (C).

An introduction to themes and forms of poetry through a reading of selected English and American poems. Emphasis on such poetic techniques as word choice, imagery, and structure, and on such modes as the ballad, lyric, sonnet, ode and dramatic monologue.

154 (I), (II). READING DRAMA (C).

An introduction to themes and techniques of drama through a reading of selected plays. Emphasis on such matters as structure, style, staging, and tragic and comic modes.

161 (I), (II). NATURE AND LITERATURE (C).

Literature that deals with man's relationship to his environment. Topics may include changing conceptions of nature, changing attitudes toward nature. Readings may include works by Conrad, Darwin, Thoreau, Shakespeare, Frost, Homer, Faulkner.

171 (I), (II). LITERATURE AND REALITY (C).

Literature that deals with man's attempt to understand what is real, what is illusory, what illusions are profitable, necessary, dangerous. Readings may include works by Cervantes, Virginia Woolf, Plato, Shakespeare, Wallace Stevens, Kerouac.

201 (I), (II). MAJOR BRITISH WRITERS (C).

Such leading British writers before 1700 as Chaucer, Spenser, Donne, Milton, and Dryden (excluding the plays of Shakespeare).

202 (I), (II). MAJOR BRITISH WRITERS (C).

Such leading British writers after 1700 as Pope, Johnson, Wordsworth, Tennyson, Browning, Arnold, and T. S. Eliot. Normally to follow English 201.

203 (I), (II). THE ENGLISH BIBLE AS LITERATURE (C).

The several main genres of Biblical literature in their historical setting; attention to the principles of interpretation; the literary influence of the Authorized Version.

213 (I). EARLY ENGLISH LITERATURE IN TRANSLATION (C).

Readings (in translation) of works from English literature before 1100 A.D. Religious and social ideas of the

period as reflected in several types of poetry. Introduction to Old English prose.

214 (II). MIDDLE ENGLISH LITERATURE
EXCLUSIVE OF CHAUCER (C).

Readings of selected works written in the later Middle Ages in England, exclusive of Chaucer's.

215 (I). THE WORKS OF CHAUCER'S FRENCH
AND ITALIAN PERIODS (C).

The complaints, dream visions, later short poems, the translation of Boethius, and *Troilus* as combinations of medieval art and thought with pre-Renaissance motifs.

216 (II). CHAUCER'S CANTERBURY TALES (C).

A close study of the General Prologue and representative tales as examples of the poet's mature techniques and extraordinary realism.

221 (I). SHAKESPEARE (C).

Examination of Shakespeare's dramatic art and leading ideas through a study of approximately a dozen plays.

222 (II). SHAKESPEARE (C).

Same method as English 221 but with a different group of plays. Either semester or both may be taken for credit.

225 (I). SIXTEENTH CENTURY ENGLISH
LITERATURE (C).

Selections from the non-dramatic prose poetry of the early English Renaissance through the Age of Elizabeth, including such writers as Skelton, Wyatt, Surrey, More, Gascoigne, Spenser, Sidney, Raleigh, Marlowe and Shakespeare. Emphasis on the rise of humanism.

226 (II). ELIZABETHAN AND JACOBEOAN
DRAMA (C).

The drama of the English Renaissance. Selected works by several major Elizabethan and Jacobean playwrights, including Marlowe, Jonson, Chapman, Middleton, Webster, and Ford. Emphasis on the artistic and intellectual character of the English Renaissance as reflected in drama.

233 (I), (II). SEVENTEENTH CENTURY
ENGLISH LITERATURE (C).

Selections from the poetry and prose of the late Renaissance in England, including works by such authors as Donne, Jonson, Browne, Burton, Marvell, and Milton. Emphasis on the challenge of the new science to the traditional humanism.

236 (I), (II). MILTON (C).

Development of the mind and art of Milton as a figure of the English Reformation and the late Renaissance. Emphasis on *Paradise Lost*.

238 (I). DRAMATIC LITERATURE OF THE
RESTORATION AND THE EIGHTEENTH
CENTURY (C).

Approximately twenty works illustrating themes and techniques of restoration comedy, sentimental drama, and the heroic play. Emphasis on Dryden, Wycherley, Congreve, and Sheridan.

241 (I). ENGLISH LITERATURE OF THE
EIGHTEENTH CENTURY (C).

The literature of the Augustan Age. Emphasis on Swift and Pope.

242 (II). ENGLISH LITERATURE OF THE
EIGHTEENTH CENTURY (C).

The literature of the later eighteenth century, with emphasis on the Johnson Circle. A continuation of English 241; may be elected independently.

243 (I), (II). THE ENGLISH NOVEL FROM
DEFOE THROUGH AUSTEN (C).

Significant representative novels, including works of such authors as Richardson, Fielding, Sterne, and Smollett.

251 (I). THE ROMANTIC POETS (C).

The Romantic Movement as revealed in the poetry of Wordsworth, Coleridge, and the other early Romantics.

252 (II). THE ROMANTIC POETS (C).

The Romantic Movement, with particular attention to Byron, Shelley, and Keats.

253 (I), (II). THE ENGLISH NOVEL FROM
SCOTT THROUGH HARDY (C).

The reading and discussion of significant representative novels, including works of such authors as Dickens, Thackeray, the Brontës, Eliot, and Hardy.

255 (I). ENGLISH PROSE OF THE ROMANTIC
PERIOD (C).

The techniques and ideas of the chief prose writers (from 1798 to 1837), including Wordsworth, Coleridge, Lamb, Hazlitt, DeQuincey, and the early Carlyle.

256 (II). ENGLISH PROSE OF THE VICTORIAN
PERIOD (C).

The chief Victorian prose writers (from 1837 to 1900), including Macaulay, Carlye, Newman, Arnold, Mill, Ruskin, Huxley, and Pater.

259 (I), (II). VICTORIAN POETRY (C).

The chief poets from 1837 to 1900. Emphasis on Tennyson, Browning, Arnold, and the Pre-Raphaelite Movement.

261 (I). THE MODERN NOVEL: 1890-1930 (C).

The expanding form of the novel and increasing interest in social causes as exhibited in some twelve novels.

262 (II). THE MODERN NOVEL: 1930-1960 (C).

Analysis of some twelve novels. A continuation of English 261, but may be elected independently.

263 (II). MODERN BRITISH AND AMERICAN
DRAMA (C).

Representative dramatists since the late nineteenth century, including Shaw, O'Casey, O'Neill, Williams, and others. Emphasis on trends in twentieth-century dramatic art.

264 (I). MODERN EUROPEAN DRAMA
(in translation) (C).

Major modern dramatists beginning with Ibsen and including Chekhov, Pirandello, Strindberg, Giraudoux. Emphasis on comparative currents in various European nations.

265 (I). TWENTIETH-CENTURY LITERATURE
OF IRELAND IN ENGLISH (C).

Nineteenth-century background; the Irish Renaissance; such major figures as Yeats, Synge, Joyce, and O'Casey; recent and contemporary writing.

266 (I), (II). MODERN POETRY (C).
Twentieth-century poetry to 1945; such authors as Hardy, Hopkins, Whitman, and Emily Dickinson.

267 (I), (II). CONTEMPORARY POETRY (C).
Poetry in English since 1945.

268 (I), (II). JAMES JOYCE (C).
Major works of James Joyce in prose, drama, and lyric poetry, emphasizing *Ulysses* or *Finnegans Wake*.

271 (I). EARLY AMERICAN LITERATURE (C).
From the Puritan, Colonial, and Federalist periods. Authors include Edward Taylor, Cotton Mather, Jonathan Edwards, John Woolman, Benjamin Franklin, Charles Brockden Brown, Philip Freneau, and Washington Irving.

272 (I), (II). AMERICAN POETRY (C).
American poetry from 1800 to the emergence of a modern style early in the twentieth century.

273 (I), (II). NINETEENTH-CENTURY AMERICAN LITERATURE (C).
Significant productions in expository prose, fiction, and poetry; the emergence of an American literature.

274 (II). TWENTIETH-CENTURY AMERICAN LITERATURE (C).
Movements, modes, and representative voices in prose, fiction, and poetry. A continuation of English 273; may be elected independently.

275 (I), (II). MAJOR AMERICAN WRITERS (C).
Emerson, Hawthorne, James, and any of the following by announcement each semester: Howells, Adams, Dos Passos, Lewis, Anderson, Fitzgerald, Hemingway.

276 (I), (II). MAJOR AMERICAN WRITERS (C).
Thoreau, Melville, Whitman, and any of the following by announcement each semester: Cooper, Poe, Dickinson, Twain, Crane, Dreiser, Faulkner, Wolfe.

280 (I), (II). INTRODUCTION TO FOLKLORE (C).
Beginning with the ballad as the nucleus of other folklore genres.

281 (II). AMERICAN FOLKLORE (C).
Oral traditions in America, with emphasis on surviving British lore, American Indian lore, Negro lore, and recent folk materials.

282 (I). LITERARY CRITICISM: CLASSIC AND NEO-CLASSIC (C).
An introduction to literary criticism; emphasis on the major philosophical critics from Plato and Aristotle to the nineteenth century.

283 (II). MODERN LITERARY CRITICISM (C).
Theories and techniques of modern criticism; emphasis on the twentieth century.

284 (I). LITERATURE AND PSYCHOLOGICAL CRITICISM (C).
An examination and application of theories and techniques of psychological criticism to selected works of literature. The theoretical focus is psychoanalytic

(Freudian); other theories (Jungian, phenomenological, existential) used as time permits.

288 (I). THE POLITICAL NOVEL (C).
Relationships between politics and the novel. Political setting vs. political meaning. Social change, power politics and institutions, and the personal dilemma. Emphasis on literary analysis and class discussion.

289 (I). FILM AND LITERATURE (C).
The historical, formal, and aesthetic relationships between literature and the cinema. Emphasis on problems raised in literary aesthetics as a result of film.

312 (I), (II). HISTORY OF THE ENGLISH LANGUAGE.
The development of English; vocabulary and usage levels, grammars, and dictionaries. Attention to matters crucial to the teaching of English in secondary schools.

321 (I). STRUCTURE OF MODERN ENGLISH.
Introduction to applied English linguistics; sounds, forms, and word-order of modern Standard American English; modern grammatical theory.

331 (I), (II). TECHNICAL WRITING.
For majors in engineering. Factual and inductive exposition, with emphasis on research, federal, and industrial reports. 2 class hours. *Credit, 2.*

334 (II). ADVANCED TECHNICAL WRITING.
Case studies in engineering and industrial reporting and in the writing of technical and professional articles. Prerequisite, permission of instructor at pre-registration.

337 (I), (II). EXPOSITORY WRITING.
The writing of informative prose in the forms expected in the students' major fields: reports, articles, essays. Prerequisite, permission of instructor at pre-registration.

339 (I), (II). ARTICLE WRITING.
Magazine journalism combined with instruction in writing feature or magazine articles. Prerequisite, permission of instructor at pre-registration.

341 (I), (II). CREATIVE WRITING.
Intensive practice in writing prose fiction, poetry, and occasionally other forms, supplemented by discussion of ideas and techniques in contemporary literature.

345 (I or II as enrollment warrants). CREATIVE WRITING.
A continuation of English 341, with emphasis on fiction.

346 (I or II as enrollment warrants). CREATIVE WRITING.
A continuation of English 341, with emphasis on poetry.

347 (I or II as enrollment warrants). CREATIVE WRITING.
A continuation of English 341, with emphasis on drama.

Note: English 345, 346, and 347 may be repeated for an additional 3 credits.

360 (I). THE ENGLISH LYRIC (C).
The lyric as a personal expression of the poetic imagination within a continuing tradition. Important forms of the lyric, such as sonnet, elegy, and ode; examples selected from the whole range of poetry in English.

361 (I). THE ENGLISH EPIC TRADITION (C). Substantial readings in three or four long English poems (such as *Beowulf*, *Faerie Queene*, *Paradise Lost*, *The Prelude*) against the background of classical epic (e.g., *The Aeneid*). Emphasis on the ways in which each poet employs traditional epic motifs as a means of defining his own contemporary vision of man and society.

362 (I). TRAGIC DRAMA (C). An examination of plays (mostly Greek, Elizabethan and modern) and critical theories (modern, but with attention to Aristotle and Hegel) in an attempt to sharpen perception of the genre "tragedy."

363 (II). PROSE FICTION (C). The substance and theory of prose fiction. Sections may read works that illustrate the range of possibilities within the genre, works that seek to extend the limits of the genre, or works that illustrate one or more types of fiction, such as the historical novel, the novel of manners, the picaresque novel, or the regional novel.

364 (II). SATIRE, THEORY AND PRACTICE (C). Theory and practice of satire, drawing upon a wide range of representative works, largely British and American, from several periods, including novels, short stories, poems, plays and essays, as well as songs, graphics, and when available, film.

380 (I), (II). ASPECTS OF LITERATURE (C). An aspect of literature in English, both British and American, including literary movements, the relations of literature to particular cultural developments, and thematic criticism.

381 (I), (II). ASPECTS OF BRITISH LITERATURE (C). An aspect of British literature. Specific subject announced at pre-registration.

382 (I), (II). INDIVIDUAL BRITISH AUTHORS (C). Intensive study of one British author, announced at pre-registration.

383 (I), (II). ASPECTS OF AMERICAN LITERATURE (C). An aspect of American literature, announced at pre-registration.

384 (I), (II). INDIVIDUAL AMERICAN AUTHORS (C). Intensive study of one American author, announced at pre-registration.

385, 386. INDEPENDENT STUDY. Individual study of a selected problem for qualified students. By arrangement with members of the department. *Credit, 1-3.*

390 (I), 391 (II). SEMINAR. Normally, several seminars each semester. Topics and instructors announced at pre-registration. For majors, but open to others. Prerequisite, permission of instructor at pre-registration.

393 (I) or (II). WRITING SEMINAR. Writing for publication and training in editing related to professional and to University student publications.

FRENCH AND ITALIAN

Prerequisite, permission of instructor at pre-registration. 2 class hours, 1 laboratory period.

399 (I) and (II). ENGLISH HONORS. The Senior Honors Thesis: a two-semester project normally carrying six credits upon completion. Qualified students are invited to join the project in the spring of their junior year.

JOURNALISTIC STUDIES

The concentration in Journalistic Studies offers a double major (15 credits in Journalistic Studies and the requirements of the associated department). The interdepartmental major is open to upper-class students on written approval from the adviser for Journalistic Studies.

Students electing this concentration must elect at least three of the following seven *content* (as distinguished from *writing*) courses in Journalistic Studies: 201, 202, 208, 210, 385, 386, 392.

Any two of the advanced writing courses offered by the Department of English are acceptable in meeting the major requirements of 15 credits in Journalistic Studies; but only one such course may be elected each semester.

201 (I) (II). INTRODUCTION TO MASS COMMUNICATION. The communications revolution and freedom of the press, the communication process, methods of reporting and writing, communication theory and research.

202 (I) (II). LANGUAGE AND COMMUNICATION. Analysis of several approaches to language study, with emphasis on empirical research.

208 (I or II as enrollment warrants). COMMUNICATIONS THEORY. Introduction to journalism as a social and behavioral science concerned with the way in which communications are arranged in our society.

210 (I or II as enrollment warrants). INTERNATIONAL COMMUNICATIONS. Comparative study of mass media in countries other than the United States, and of the flow of communications among nations.

385 (I), 386 (II). INDEPENDENT STUDY AND RESEARCH. Individual work for well-qualified juniors and seniors. Prerequisite: permission at pre-registration of staff member who is to supervise.

392 (II). FREEDOM OF THE PRESS. Seminar in freedom of the press: (1) its history, (2) major theories, (3) key cases in Anglo-American law, and (4) recent trends toward redefinition.

French and Italian

Acting Chairman of Department: Professor Micheline Dufau.

FRENCH

Professors Cassirer, R. Johnson, Taylor, Weiner; Associate Professors Busi, Carre, P. Johnson, S. Lawall, Mankin, Porter, Raymond, Rountree, Smith, Sturm; Assistant Professors Azibert, Berwald, Bragger, Chen, Garaud, Gugli, Lamb, O'Connell; Instructors Allard, Carcich, Lee, Sachs, Tedeschi; Visiting Professors Hytier, Marks.

110, 120. ELEMENTARY FRENCH.

For those with no previous creditable training in French. Intensive practice in the four language skills. Sequence: French 110, 120, 130, 140. 3 class hours, 2 laboratory periods.

123 (I), (II). INTENSIVE REVIEW OF FRENCH.

Intensive review of French for those who are not ready for third semester work.

126 (I), (II). INTENSIVE ELEMENTARY FRENCH.

For those with no previous training in French. Intensive practice in the four language skills.

130 (I), (II). INTERMEDIATE FRENCH.

Intensive study and review. Readings in modern French literature. Prerequisite, either French 123 or 126, or equivalent.

131 (I), (II). INTERMEDIATE FRENCH: ORAL.

A third semester course for those primarily interested in developing their oral skills in French.

132 (I). INTERMEDIATE FRENCH – HONORS or MAJORS (C).

For honor students and majors. Intensive review of grammar with emphasis on all four skills.

141 (I), (II). INTERMEDIATE FRENCH: ORAL.

A continuation of 131.

142 (I), (II). INTERMEDIATE FRENCH: HONORS or MAJORS (C).

For honor students and majors. Stresses composition as well as reading and discussion.

144 (I), (II). INTERMEDIATE FRENCH: FICTION (C).

Stresses the reading of contemporary fiction.

145 (I), (II). INTERMEDIATE FRENCH: READINGS IN THE HUMANITIES (C).

Stresses reading of non-fiction.

146 (I), (II). INTENSIVE INTERMEDIATE FRENCH (C).

Covers third and fourth semesters in one. *Credit, 6.*

147 (I), (II). INTERMEDIATE FRENCH: READINGS IN THE SOCIAL SCIENCES (C).

148 (II). INTERMEDIATE FRENCH: READINGS IN MATHEMATICS AND SCIENCES (C).

161 (I), (II). ORAL FRENCH, PHONETICS AND PHONEMICS.

Intensive practice of French pronunciation through a knowledge of its sound system.

162 (I), (II). CONVERSATION.

Practice in conversational French. Prerequisite, French 161.

171 (I), (II). GREAT WORKS – POETRY, NOVEL (C).

Selected complete works of several periods in poetry and novel. Prerequisite for advanced courses in French.

172 (I), (II). GREAT WORKS – THEATER, ESSAY (C).

Selected complete works of several periods in non-fiction and the theater. Prerequisite for advanced courses in French.

261 (I), (II). ADVANCED GRAMMAR.

For students who feel the need of more formal French grammar beyond the intermediate level.

262 (I), (II). ADVANCED CONVERSATION.

Additional oral practice for students who have completed French 161-162. (Students who have completed 161 and who have a strong background in oral production may be excused from 162 by permission of the Department.)

263 (I), (II). FRENCH COMPOSITION.

Advanced composition, required of French majors.

264 (I), (II). COMPOSITION AND TRANSLATION.

Advanced composition, required of French majors.

270 (I) or (II). THEMES IN FRENCH LITERATURE (IN TRANSLATION).

A given theme in French literature as illustrated in a series of translated works. Themes announced in advance. Not to be taken for major credit in French.

271 (I). FRENCH CIVILIZATION.

French Civilization to 1800. Designed for an intelligent understanding of the literature and thought of France through a knowledge of the background.

272 (II). FRENCH CIVILIZATION.

Designed for an intelligent understanding of contemporary French literature through a knowledge of its recent background.

274 (I) or (II). MASTERPIECES IN TRANSLATION (C).

The vision of man in French literature from the Renaissance to the twentieth century. Not open to French majors or to students who have completed either French 171 or 172.

301-302. FRENCH LITERARY MOVEMENTS.

The characteristics and definitions of a selected movement or period (*e.g.*, Baroque, Romanticism) in French literary history.

303. EXPLICATION DE TEXTES.

The principles of textual analyses and practice in that exercise. Required of students in Teacher Training.

304. THE ART OF LITERATURE.

The structure of the literary works of art; emphasis on the esthetic.

311 (I) or (II). INTRODUCTION TO MEDIEVAL
FRENCH LITERATURE.

Representative masterpieces from the various genres, read in modern French translation. Relation of literature to other aspects of medieval culture.

314 (I). FRENCH PROSE OF THE
RENAISSANCE.

Renaissance French prose. Rabelais, Bonaventure des Périers, Marguerite de Navarre, Monluc, Les Estienne, Montaigne.

317 (II). FRENCH POETRY OF THE
RENAISSANCE.

Renaissance French poetry. Marot, Scève, Du Guillet, Du Bellay, Ronsard, Belleau, Baif, Agrippa d'Aubigné, Du Bartas, Sponde.

321. COMIC VISION – 17th CENTURY.

Representative works of the classical period with a comic vision of society in prose and poetry: Molière, La Fontaine, La Bruyère and others.

322. TRAGIC VISION – 17th CENTURY.

Examples of the classical tragic vision in the theater and the novel; Corneille, Racine, Mme. De La Fayette.

324. PHILOSOPHERS AND MORALISTS OF
THE 17th CENTURY.

Writers whose ideas are most important in classical thought: Descartes, Pascal, La Rochefoucauld and others.

334. FRENCH LITERATURE OF THE
18th CENTURY.

Development of ideas of the French Enlightenment.

335. FRENCH NOVEL OF THE 18th CENTURY.
The satirical novel as represented by LeSage, Montesquieu, Voltaire, and Diderot, and the sentimental novel as represented by Prévost, Marivaux, Rousseau and Bernardin de Saint-Pierre.

339. FRENCH DRAMA OF THE 18th CENTURY.
Readings in French theater from LeSage to Beaumarchais.

340. THEMES IN 19th CENTURY FRENCH
POETRY.

In-depth consideration of themes in 19th century French poetry such as nature, the religious experience, the role of the poet, romantic imagery, etc. Themes vary from semester to semester.

344. PARNASSIANS AND NERVAL.

Development of poetry between Romanticism and Symbolism.

345. 19th CENTURY ROMANTIC NOVEL.

The novel of the first half of the century: Chateaubriand, Balzac, Hugo, Dumas, Stendhal.

346. 19th CENTURY REALISTIC-NATURALISTIC
NOVEL.

The novel of the second half of the century from Flaubert to Zola.

347. FRENCH POETRY OF THE EARLY
19th CENTURY.

Nineteenth century French Romantic poetry: LaMartine to Hugo.

348. SYMBOLIST POETRY.

The poetry of Baudelaire, Rimbaud, Mallarmé, Verlaine.

349. FRENCH THEATER OF THE 19th CENTURY.
Development of theater from Hugo to Rostand and his contemporaries.

354. LITERATURE IN FRENCH FROM AFRICA
AND THE CARIBBEAN.

Survey of contemporary literature written in French by African writers, and its literary and ideological background.

355. MAJOR FIGURES OF THE
CONTEMPORARY FRENCH NOVEL.

Novels of Romans, Martin du Gard, Duhamel, Gide, Proust, Montherlant, Giraudoux.

356. MAJOR FIGURES OF THE
CONTEMPORARY FRENCH NOVEL.

Novels of Malraux, Camus, Sartre, Simone de Beauvoir, Bernanos, Mauriac, and Julien Green.

357. CONTEMPORARY FRENCH POETRY –
20th CENTURY.

Major French poets from the turn of the century to Surrealism. A study of Valéry, Apollinaire, Claudel, Reverdy, Eluard, Desnos, Cendrars, and the beginnings of Surrealism with the first manifesto in 1924.

358. CONTEMPORARY FRENCH POETRY –
20th CENTURY.

French poetry from Surrealism to the present: Breton, Char, Michaux, Perse, Ponge, Bonnefoy, and selected contemporary poets. Surrealism as a movement in itself and as a precursor of more recent poetry.

359. FRENCH THEATER – 20th CENTURY.

French theater from Scribe to the present.

361. APPLIED FRENCH LINGUISTICS.

French linguistics applied to the teaching of French in secondary schools.

362. BASIC METHODS.

An introduction to audio-lingual techniques of teaching French at the secondary level (Educ 307).

363. ADVANCED METHODS.

Methods of teaching intermediate and advanced French at the secondary level. The second of a two-semester sequence devoted to teaching French. Prerequisite, French 362 (Educ 307).

385, 386. SPECIAL PROBLEMS.

Individual study of a selected problem for qualified students. By arrangement with members of the department.
Credit, 1–3.

390, 391, 392. SENIOR SEMINAR.

French literature for advanced students. Subject announced the preceding semester.
Credit, 1–3.

398, 399. FRENCH SENIOR HONORS. *Credit, 1–6.*

ITALIAN

Associate Chairman for Italian: Associate Professor Zina Tillona. Associate Professor Sturm; Assistant Professors Bongiorno, Fata, Gugli; Instructors Severino, Terrizzi, Triolo.

110, 120 (I), (II). ELEMENTARY ITALIAN.
For students with no previous creditable training in Italian. Intensive practice in language skills.

126 (I), (II). INTENSIVE ELEMENTARY ITALIAN.
For students with no previous creditable training in Italian. Intensive training in all language skills. Equivalent of 110, 120. *Credit, 6.*

130, 140 (I), (II). INTERMEDIATE ITALIAN (140:C).
For students with one year of college Italian or equivalent. Training in the language skills; emphasis on speaking and understanding; readings in cultural and literary texts.

146 (I), (II). INTENSIVE INTERMEDIATE ITALIAN (C).
For students with one year of college Italian or equivalent. Reinforcement of basic language skills, further training in all skills. Reading and discussion of literary and cultural texts. Equivalent of 130, 140. *Credit, 6.*

161 (I), 162 (II). INTRODUCTION TO ITALIAN LITERATURE (C).
Close reading of representative works in Italian literature. Training in the techniques of literary analysis of the main literary forms. Prerequisite for advanced courses in Italian.

181 (I), 182 (II). ORAL ITALIAN.
Oral aspect of the language; pronunciation, vocabulary building, speeches, discussions, debates.

250. ITALIAN CIVILIZATION.
Historical, literary, philosophic and artistic aspects of Italian civilization. Provides understanding of Italian life and culture.

255. ITALIAN COMPOSITION.
Advanced composition. Primarily for Italian majors; open to all qualified.

290. ITALIAN LITERATURE IN TRANSLATION I (C).
Representative works of Italian literature through 1700. Not open to Italian majors.

291. ITALIAN LITERATURE IN TRANSLATION II (C).
Representative works of Italian literature from 1700 to the present. Not open to Italian majors.

292. DANTE IN TRANSLATION.
The works of Dante Alighieri in English translation; emphasis on the *Divine Comedy*.

301 (I), 302 (II). DANTE AND THE DUECENTO.
Selections from the works of Dante and his contemporaries; intensive study of the *Divine Comedy*.

307. BASIC METHODS.

Introduction to audio-lingual techniques of teaching Italian at the secondary level and contrastive analysis of the structures of Italian and English (Educ 307).

310. PRE-HUMANISM AND THE EARLY RENAISSANCE.

Literature of the fourteenth and early fifteenth centuries: Petrarca, Boccaccio, Poliziano, Alberti, Sacchetti.

315. THE HIGH RENAISSANCE.

Literature of the late fifteenth and sixteenth centuries: Machiavelli, Castiglione, Ariosto, Tasso.

330. ITALIAN LITERATURE OF THE EIGHTEENTH CENTURY.

Significant currents and authors from Goldoni to Alfieri.

335. NEO-CLASSICISM AND ROMANTICISM.

Intensive study of the works of Foscolo, Leopardi and Manzoni.

340. MODERN THEATER.

Italian theater from Verga to the present.

345. MODERN POETRY.

Italian poetry from Carducci to the present. Emphasis on hermetism.

350. MODERN ITALIAN NOVEL.

Development of the novel from Verga to the present.

385, 386. SPECIAL PROBLEMS.

Individual study of a selected problem for qualified students. By arrangement with members of the department. *Credit, 1-3.*

390. SEMINAR IN ITALIAN LITERATURE.

Italian literature for advanced students. Subject announced the preceding semester.

Geology and Geography

Acting Head of Department: Professor Joseph H. Hartshorn. Professors Bromery, Farquhar, Hubert, Jaffe, Smith, Wise; Associate Professors Hall, Hayes, McGill, Morse, Motts, Pitrat, Robinson, Webb; Assistant Professors Doehring, Haggerty, Nelson; Instructor Rice.

Geography Faculty: *In charge of program:* Associate Professor Terence Burke; Assistant Professors Hafner, Meyer, Nostrand, Wilkie.

GEOLOGY

100 (II). PHYSICAL GEOLOGY (E).

The nature and origin of the landscape features of the earth and their underlying rocks and structures, including the work of rivers, waves and currents, wind, and glaciers; the role of earthquakes, volcanoes, and the processes of mountain-building. 2 class hours, 1 2-hour laboratory period, 1 1-hour quiz-discussion, and field trips. *Staff.*

101 (I), (II). PHYSICAL GEOLOGY (E).

Content similar to 100. 2 class hours, 1 3-hour laboratory period, and field trips. *Mr. Rice.*

GEOLOGY AND GEOGRAPHY

105 (I). GEOLOGY AND MAN (E).

Evidence for selected mineral-forming processes; minerals in industry; developments in mineral research and technology; geologic considerations in such engineering works as mines, foundations, tunnels, waterways, and airfields. Mr. Farquhar.

106 (I). THE FACE OF THE EARTH (E).

Landforms of the world and their origin by gravity, wind, water, waves, and glaciers. Emphasis on the relation of geology to landscape in the United States. Mr. Hartshorn.

107 (II). ORGANIC EVOLUTION AND THE GEOLOGIC RECORD (E).

The adaptations of selected lineages of animals to the changing environments of the geologic past. Emphasis on those groups which best illustrate evolutionary principles or unsolved problems. Not open to those who have taken Geol 240. 2 class hours, 1 2-hour laboratory period. Mr. Pitrat.

108 (I). EVOLUTION OF THE EARTH'S CRUST (E).

Application of geologic and oceanographic studies to problems of crustal evolution, including continental drift, the origins of mountains, continents, and ocean basins, and the formation of fossil fuels. 2 class hours, 1 2-hour laboratory-discussion period. Mr. Webb.

120 (II). ENVIRONMENTAL GEOLOGY (E).

Principles of geology applied to regional planning in areas of conservation, land use, water resources, and water pollution; preservation of open spaces, wilderness areas, state and national park systems. Prerequisite, Geol 100, 101, or 130. Mr. Motts.

121 (I). LUNAR AND PLANETARY GEOLOGY (E).

Application of basic geologic principles to study of terrestrial planets; processes acting on the moon and terrestrial planets; geologic history of the moon. 2 class hours, 1 2-hour laboratory-discussion period. Prerequisite, 1 semester of geology or permission of instructor. Mr. McGill.

130 (I), (II). SEMINARS IN GEOLOGY (HONORS) (E).

Topics in geology, as determined by faculty and students involved. 2 class hours, 1 4-hour laboratory and field trips. Staff.

160 (I), (II). INTRODUCTORY FIELD METHODS.

Interpretation and use of topographic maps and sections in laboratory and field; use of basic field equipment and techniques. 1 class hour, 1 5-hour laboratory period. Prerequisite, an introductory geology course. Credit, 2. Mr. Rice.

192 (I), (II). MINERALOGY (E).

Chemical composition, physical properties, crystallography, and genesis of common minerals. Laboratory technique for recognition of minerals. Prerequisites, an introductory geology course; Chem 111 and 112 (may be taken concurrently). 2 class hours, 2 2-hour laboratory periods, and field trips. Credit, 4. Mr. Haggerty, Mr. Nelson.

220 (II). INTRODUCTORY PETROLOGY.

Rocks, with emphasis on constituent minerals, textural and structural features, classification, mode of occur-

rence, and origin. Laboratory includes introduction to petrographic methods. The course is a sequel to Geol 192 as the second half of a one-year study of minerals and rocks. Prerequisite, Geol 192. 2 class hours, 2 2-hour laboratory periods, and field trips by arrangement. Credit, 4. Mr. Jaffe, Mr. Morse.

230 (I). FIELD AND STRUCTURAL GEOLOGY I.

Basic methods of field geology; occurrences and recognition of geologic structure; preparation and interpretation of geologic maps; solution of simple structural problems. Prerequisites, Math 123; either Geol 100, 101, or 130; or alternatively Geol 105, 106, 107, or 108 and 160. 2 class hours, 1 5-hour laboratory period, week-end and holiday field trips. Credit, 4. Mr. Hall, Mr. McGill, Mr. Wise.

231 (II). FIELD AND STRUCTURAL GEOLOGY II.

Structural and dynamic analysis of deformed rocks; introduction to tectonics; field study of complex areas. Prerequisites, Geol 220, 230. 1 class hour, 1 5-hour laboratory period, week-end and holiday field trips. Mr. Hall, Mr. Robinson, Mr. Wise.

240 (I). INVERTEBRATE PALEONTOLOGY.

The history, development, and identification of invertebrate animal fossils. Field trips by arrangement. Prerequisites, either Geol 100, 101, or 130; or alternatively Geol 105, 106, or 108 and 160. 3 class hours, 1 2-hour laboratory period. Credit, 4. Mr. Pitrat.

250 (I). SEDIMENTOLOGY.

Analysis and origin of primary sedimentary structures; composition and classification of sedimentary rocks; and criteria for identification of depositional environments in the rock record. Prerequisite, Geol 220. 2 class hours, 1 2-hour laboratory period, and field trips. Mr. Hubert.

251 (II). STRATIGRAPHY AND HISTORICAL GEOLOGY.

Principles of stratigraphic correlation; methods of reconstruction of earth history; tectonic evolution of selected regions. Prerequisites, Geol 220, 230, 240, 250, or permission of instructor. 2 class hours, 1 3-hour laboratory period. Mr. Webb.

280 (II). ENGINEERING GEOLOGY.

Not open to geology majors. Materials and surface features of the earth with emphasis on engineering problems; map reading as related to the phenomena of physical geology. 2 class hours, 1 3-hour laboratory period or field trip. Mr. Farquhar.

311 (I). OPTICAL MINERALOGY.

Principles of optics; optical properties of minerals and methods for their measurement; relationship between optical properties and crystallography; microscopic techniques for mineral identification; crystal chemistry of rock-forming minerals. Prerequisites, Geol 220, Physics 141 and 142. 3 class hours, 1 3-hour laboratory period. Mr. Hall, Mr. Jaffe, Mr. Morse.

321 (II). PETROGRAPHY.

Identification of minerals in thin section; common igneous, sedimentary, and metamorphic rocks in thin section; petrographic calculations and measurements; introduction to petrogenetic theory. Field examination

of selected igneous and metamorphic rocks. Prerequisites, Geol 220 and Geol 311. 3 class hours, 1 3-hour laboratory period, and field trips. Mr. Robinson.

330 (I). TECTONICS.

Past and present mechanisms creating the broader framework of global geology, mountain-building, ocean-basin structure, continental drift, mantle processes, continental evolution, early history of the earth, structural geology of selected key regions of the globe. Prerequisites, Geol 231, 220. 2 2-hour class meetings. Mr. Wise.

334 (I). ASTROGEOLOGY.

Geology of the solar system with emphasis on the solid bodies: age, sequence of events, composition, surficial and internal geologic processes. Photogeologic mapping of selected portions of Moon and Mars using recent imagery from the space program. Prerequisites, Geol 231, 220. 2 2-hour class meetings. Mr. Wise.

355 (I). PHYSICAL OCEANOGRAPHY.

Physical properties of sea water and their variations; water masses and their circulation patterns; interaction between ocean and atmosphere; dynamics of waves, tides, and ocean currents; techniques of oceanographic study. Prerequisites, two years of college work toward a major in science or engineering: Physics 141 and 142, or 161, 162, and 163; calculus recommended. 3 class hours and field trips. Mr. Hayes.

360 (I). GEOMORPHOLOGY.

Origin and development of landforms in relation to geological processes, climate, and tectonic history. Application of geomorphic methods to interpretation of geologic history. 2 class hours, 1 3-hour laboratory period. Prerequisites, Geol 230 or permission of instructor. Mr. Doehring.

366 (II). PLEISTOCENE GEOLOGY.

Geochronology of Pleistocene time as related to climatic changes; glaciology, erosional and depositional processes, landforms, sedimentary deposits, shifting sea level, and the paleontological record. 2 class hours, 1 3-hour laboratory period. Field trips by arrangement. Prerequisites, either Geol 100, 101, 130, or permission of instructor. Mr. Hartshorn.

368 (II). PHOTO GEOLOGY AND REMOTE SENSING.

Techniques for making measurements and preparing base maps and geologic maps from vertical and oblique aerial photos; interpretation of cultural, geologic, and geomorphic features; introduction to remote sensing methods, including multispectral aerial photography, infrared imagery, and radar. Prerequisite, Geol 231; Geol 360 recommended. 6 laboratory and lecture hours to be arranged. Mr. Smith.

370 (I). GEOPHYSICS.

The physics of the earth and the gravitational, magnetic, electrical, and seismic methods of geophysical exploration. Laboratory problems and computations. Prerequisites, Physics 141, 142; Geol 230 and 220 or permission of instructor. 3 class hours and laboratory work by arrangement. Mr. Bromery.

388. SPECIAL PROBLEMS.

Individual study of a selected problem for qualified students. By arrangement with members of the department. *Credit, 1-6.*

389 (I), (II). FIELD PROBLEMS.

Directed field study and/or research. With permission of the department may be used to satisfy B.S. field experience requirement. Prerequisites, Geol 220 and 230. *Credit, 2-6.* Staff.

390 (I), (II). SEMINAR.

Participation in department's professional seminar. Prerequisites, Geol. 220, 230, or permission of department. *Credit, 1 each semester (limited to 2 credits toward graduation).* Staff and students.

399 (I), (II). DEPARTMENTAL HONORS.

Open to students of high academic standing by invitation of the department. Two semesters of supervised independent research leading to an Honors Thesis. *Credit, 6 in second semester.* Staff.

GEOGRAPHY

135 (I), (II). FUNDAMENTAL CONCEPTS AND PATTERNS.

The fundamental physical and human patterns of the earth's surface. Fundamental geographic concepts of region, spatial association, and spatial interaction. 2 class hours, 1 2-hour laboratory period, and field trips. Staff.

155 (I), (II). INTRODUCTION TO HUMAN GEOGRAPHY (D).

The spatial attributes of human societies; population, cultural characteristics, settlement, and economic activity. Selected regional case studies. 2 class hours. 1 2-hour laboratory period, and field trips. Staff.

156. HUMAN GEOGRAPHY (D).

Honors student section with an individual lab meeting time, but joint lectures with Geog 155.

200 (II). GEOGRAPHY OF ANGLO-AMERICA (D).

The contemporary physical and cultural geography of the United States and Canada approached by region and topic. Mr. Nostrand.

205 (I). HISTORICAL GEOGRAPHY OF THE UNITED STATES (D).

The development of basic physical, biotic, and cultural processes that have shaped successive demographic and cultural patterns in America's changing geography. Mr. Nostrand.

220 (I). GEOGRAPHY OF LATIN AMERICA (D).

A survey of the spatial organization of cultural and physical regions of Latin America. Emphasis on the dynamic change processes affecting man's horizontal linkages and use of the environment. Mr. Wilkie.

231 (I). GEOGRAPHY OF EAST ASIA (D).

An introductory examination of the geographical components of East Asia, China, Japan, and Korea with emphasis on physical, human, and economic resources and their continuity. Prerequisites, Geog 135 or 155 or permission of instructor. Mr. Hafner.

232 (II). GEOGRAPHY OF SOUTHEAST ASIA (D).

An introductory survey of the cultural, economic, and human geographic components of Southeast Asia that

contribute to regional uniformity and diversity. Emphasis on contemporary problems of regional development and integration. Prerequisites, Geog 135 or 155 or permission of instructor. Mr. Hafner.

240 (I). QUANTITATIVE METHODS IN GEOGRAPHY.

Applications of statistical techniques to geographic problems: probability functions useful in geographic analysis, methods of spatial sampling, point pattern analysis, and spatial relations and areal associations. Prerequisites, Stat 121 or 232 or permission of instructor. Mr. Meyer.

250 (I), (II). CARTOGRAPHY.

A systematic introduction to the presentation of physical and human variables cartographically. Emphasis on drafting techniques, map making, and problems of compilation, analysis, and graphic presentation of data. 2 2-hour lecture and laboratory periods. Mr. Wilkie.

260 (I). ECONOMIC GEOGRAPHY (D).

The distribution, production and utilization of the natural resources and commodities on which man's livelihood depends and the problems which they pose. Mr. Burke.

270 (I). URBAN SPATIAL ORGANIZATION (D).

Development of spatial systems of cities. Processes producing internal spatial structure of cities. Mr. Meyer.

271 (II). SEMINAR IN URBAN GEOGRAPHY.

A selected topic in urban geography. For example, cross-cultural spatial structure of cities, Afro-American urban spatial organization, or urban regional development. Prerequisite, Geog 270 or permission of instructor. Mr. Meyer.

280 (II). POLITICAL GEOGRAPHY (D).

The spatial interaction between political regions and geographic space considered in its physical and cultural components. Emphasis on the nation-state and on problems at the interface between nation-states. Prerequisites, Geog 135 or 155 or Poli Sci 160-161 or permission of instructor. Mr. Burke.

380 (I). PROBLEMS IN POLITICAL GEOGRAPHY (D).

The political geography of selected regions or selected problems of general significance. Prerequisites, Geog 280 or permission of instructor. Mr. Burke.

385, 386. SPECIAL PROBLEMS.

Individual study of a selected problem for qualified students. By arrangement with members of the department. Credit, 1-3.

390 (I), 391 (II). SEMINAR.

Some restricted problem or region within geography. Prerequisites, two upper-division courses in geography or permission of geography staff. Staff.

Germanic Languages and Literatures

Head of Department: Carroll E. Reed. Professors Denkler, Malsch, Paulsen, Ryan; Associate Professors Beekman, Born, Lea, von Kries, Meid, Reh, Schiffer; Assistant Professors Bauschinger, Cathey, Haupt, Peter, Seelig; Instructor Hugus.

To fulfill an undergraduate major in German, a stu-

dent must complete 33 credits in the department's junior-senior courses. Two programs are available: Program A is designed principally for those who wish to teach in elementary or secondary schools, Program B for those who are primarily interested in continuing their studies in graduate school.

Students selecting Program A should take 161, 201, 202, 211, 221, 241, 283 and 284, and a minimum of three courses in German literature, one of which must be in the twentieth century (331, 332, 333, or 334.)

Students selecting Program B should take 161, 201, 202, 211, 221, 284, 321, and 381, and one course in each of the following categories: (a) 331, 332, 333, 334, (b) 311, 312, 313, (c) 301, 302, 303.

One course in history or philosophy is required of all German majors.

Freshmen who fulfill the language proficiency requirement upon entrance should take 161 or 201.

Students are urged to supplement their course work with at least one summer session at an approved summer school of German or by participating in a summer program abroad, such as the University offers in Freiburg, Germany.

GERMAN

110, 120. ELEMENTARY GERMAN.

For the non-German major who has no previous training in German. Emphasis on understanding and reading. Sequence to be followed: German 110, 120, 130, 140. 3 class hours, 1 drill period.

112, 122. ELEMENTARY CONVERSATIONAL GERMAN.

For Honor students and prospective German majors, and those interested in intensive practice in the four language skills and who have no previous training in German. Emphasis on understanding and speaking. Sequences to be followed: German 112, 122, 132, 142 or German 112, 136, 142. 3 class hours, 1 drill period.

130, 140. INTERMEDIATE READING COURSE IN GERMAN (140:C).

Intensive review and readings in modern German literature for the non-German major. Prerequisite, German 120 or equivalent.

132, 142. INTERMEDIATE GERMAN (142:C).

For Honor students and prospective German majors, and those interested in an intensive practice in the four language skills. Emphasis on speaking and reading. Intensive review. Readings and discussion (in German) of modern German literature. Prerequisite, German 122 or equivalent. Use of tape library in the language laboratory.

136 (II). ACCELERATED GERMAN.

Recommended for Honor students and prospective German majors. Accelerated course for students interested in intensive practice in the four language skills who are selected on the basis of superior achievement in German 112. Covers the contents of German 122

and 132. Emphasis on understanding and speaking. Students completing this course qualify for German 142. 6 class hours. Use of tape library in the language laboratory. *Credit, 6.*

138, 148. SCIENTIFIC GERMAN (148:C). Recommended for Science majors. Intensive review. Readings in Mathematics and Natural Sciences with exercises in translation from German into English. Prerequisite, German 120 or 122 or equivalent.

151. FREIBURG PREPARATORY COURSE IN GERMAN.

An intensive advanced course in speaking and understanding for students planning to attend the University Freiburg Program the following year. Prerequisite, 120 or 122 or equivalent. 6 class hours (by arrangement). *Credit, 6.*

161. READINGS IN GERMAN LITERATURE (C). An introductory course, intended to increase reading comprehension and fluency. Based on selected literary texts mainly from the 19th and 20th centuries. Prerequisites, 140 or equivalent (to be established by an examination administered by the department).

201, 202. ADVANCED GERMAN.

Advanced grammar, extension of vocabulary, exercises in translation into German and in free composition and conversation. Prerequisite, German 142 or equivalent. 4 class hours. Use of tape library in the language laboratory. *Credit, 4.*

211. ADVANCED COMPOSITION, TRANSLATION AND CONVERSATION.

Continuation of 201 and 202. Emphasis on the writing of German (translation into German and free composition). Prerequisite, German 202 or equivalent. Use of tape library in the language laboratory.

221 (I). SURVEY OF GERMAN LITERATURE FROM 800 TO 1700 (C).

Prerequisite, German 161, 201 or equivalent.

222. SURVEY OF GERMAN LITERATURE FROM 1700 TO THE PRESENT (C).

Prerequisite, 161, 201 or equivalent.

231, 232. GERMAN MASTERPIECES IN TRANSLATION (C).

An introduction to selected masterpieces of German literature from the Middle Ages to the present. Different reading material in both semesters. Primarily for non-majors; majors may elect but not have major credit. May be repeated.

241. GERMAN CIVILIZATION I (C).

The political and cultural development of Germany and her role in the European tradition from the beginning to 1648. Readings in German and English. Conducted in English. Prerequisite, German 140 or equivalent.

242. GERMAN CIVILIZATION II.

The political and cultural development of Germany and her role in the European tradition from 1648 to the present. Readings in German and English. Conducted in English. Prerequisite, German 140 or equivalent.

283. METHODS OF TEACHING GERMAN.

The various methods of teaching a foreign language based on recent developments of applied linguistics and programmed learning. Emphasized are: the development of teaching materials by the individual student and the application of textbooks to the needs of various language courses. Prerequisite, German 140 or equivalent.

284. THE GERMAN LANGUAGE (C).

An introduction to the history of the German language. Prerequisite, German 140 or equivalent.

285. THE STRUCTURE OF GERMAN.

German phonetics and phonemics, with an introduction to German morphology. Prerequisite, German 140 or equivalent.

301. LESSING AND HIS TIME (C).

The preclassical German literature of the eighteenth century with emphasis on Lessing. Prerequisite, German 161, 201 or equivalent.

302. GOETHE (C).

A literary analysis of selected poems, plays and prose of the early and classical Goethe. Prerequisite, German 161, 201 or equivalent.

303. SCHILLER (C).

Selected poems, plays and essays by Schiller. Prerequisite, German 161, 201 or equivalent.

311. THE GERMAN POEM (C).

An historical survey based on a close reading of selected poems from the major phases of German poetry after 1500. Prerequisite, German 161, 201 or equivalent.

312. GOETHE'S FAUST (C).

Reading of *Faust*, Part I and selections of Part II. Prerequisite, German 161, 201 or equivalent.

313. ROMANTICISM (C).

Poetry and prose of the Romantic period. Prerequisite, German 161, 201 or equivalent.

321. 19th CENTURY LITERATURE (C).

Poetry, drama and prose with emphasis on Kleist, Büchner, Heine, Keller. Prerequisite, German 161, 201 or equivalent.

331. THE EARLY 20th CENTURY (C).

Main literary trends at the turn of the century with emphasis on Hauptmann, Hofmannsthal, George, Rilke and the early Thomas Mann. Prerequisite, German 161, 201 or equivalent.

332. BRECHT AND MODERN DRAMA.

Plays by Brecht, Frisch, Dürrenmatt and Weiss. Prerequisite, German 161, 201 or equivalent.

333. 20th CENTURY PROSE (C).

Works by authors such as Thomas Mann, Kafka, Musil and Grass. Prerequisite, German 161, 201 or equivalent.

334. CONTEMPORARY GERMAN LITERATURE.

A study of the contemporary literary scene in Germany. Prerequisite, German 161, 201 or equivalent.

391 (II). SEMINAR.

In-depth study of a particular author, problem, theme, or genre. For seniors; open to juniors by permission of instructor. Prerequisite, two literature courses on the 300 level. May be repeated for credit.

385 (I), (II). SPECIAL PROBLEMS.

Guided reading and research in areas of specialization.
Credit, 1, 2 or 3.

DANISH

110, 120. ELEMENTARY DANISH.

Conversation, reading, grammar and composition. 3 class hours, 1 laboratory hour.

126 (I). ACCELERATED ELEMENTARY DANISH.

Covers the material of Danish 110 and 120. 6 class hours, 1 laboratory hour. *Credit, 6.*

130, 140. INTERMEDIATE DANISH (140:C).

Reading, conversation, composition. Grammar review. Prerequisite, Danish 120 or 126.

146 (II). ACCELERATED INTERMEDIATE DANISH (C).

Covers the material of Danish 130 and 140. Prerequisite, Danish 120 or 126. 6 class hours. *Credit, 6.*

251. DANO-NORWEGIAN LITERATURE (C).

Masterpieces of Danish and Norwegian literature, with emphasis on Ibsen, Holberg, and some attention to the modern authors. Prerequisite, Danish 140 or 146 or equivalent.

DUTCH

110, 120. ELEMENTARY DUTCH.

Conversation, reading, grammar and composition. 3 class hours, 1 laboratory hour.

126 (I). ACCELERATED ELEMENTARY DUTCH.

Covers the material of Dutch 110 and 120. 6 class hours, 1 laboratory hour. *Credit, 6.*

130, 140. INTERMEDIATE DUTCH (140:C).

Reading, conversation, composition. Grammar review. Prerequisite, Dutch 120 or 126.

146 (II). ACCELERATED INTERMEDIATE DUTCH (C).

Covers the material of Dutch 130 and 140. Prerequisite, Dutch 120 or 126. 6 class hours. *Credit, 6.*

251. DUTCH AND FLEMISH LITERATURE (C). Masterpieces of Dutch and Flemish (Belgian) literature. Prerequisite, Dutch 140 or 146 or equivalent.

268. MODERN DUTCH FICTION IN TRANSLATION.

Masterpieces of modern and contemporary Dutch fiction in English translation; a little-known literary territory. No knowledge of Dutch required.

HISPANIC LANGUAGES AND LITERATURES

SWEDISH

110, 120. ELEMENTARY SWEDISH.

Conversation, reading, grammar and composition. 3 class hours, 1 laboratory hour.

126 (I). ACCELERATED ELEMENTARY SWEDISH.

Covers the material of Swedish 110 and 120. 6 class hours, 1 laboratory hour. *Credit, 6.*

130, 140. INTERMEDIATE SWEDISH (140:C).

Reading, conversation, composition. Grammar review. Prerequisite, Swedish 120 or 126.

146 (II). ACCELERATED INTERMEDIATE SWEDISH (C).

Covers the material of Swedish 130 and 140. Prerequisite, Swedish 120 or 126. 6 class hours. *Credit, 6.*

Hispanic Languages and Literatures

Chairman of Department: Professor Harold L. Boudreau; Professors Greenfield, Piccus, Rothberg, Wexler; Associate Professors Bancroft, De Puy; Assistant Professors Barreda-Tómas, Fernández-Turienzo, Humphrey, Scott, Sturm, Zamora; Instructors Bradford, Galvin, Loureiro, MacLeod, Pollock, Rauchwarger; Part-time Lecturers Cabrera, Klein.

PORTUGUESE

At present no major in Portuguese exists. Students wishing to do further work in this field may take approved courses at Smith College.

110 (I), 120 (II). ELEMENTARY PORTUGUESE.

For students with no previous creditable training in Portuguese. Intensive practice in the language skills. 3 class hours, laboratory.

130 (I), 140 (II). INTERMEDIATE PORTUGUESE (140:C).

For students with one year of college Portuguese or equivalent. Training in the language skills; emphasis on speaking and understanding; readings in cultural and literary texts.

161 (I), 162 (II). INTRODUCTION TO PORTUGUESE LITERATURE (C).

Selected masterpieces of Portuguese literature presented integrally, in literary-historical perspective. Conducted in Portuguese. Either semester may be elected independently. Prerequisite, Portuguese 140 or permission of department.

SPANISH

110, 120 (I), (II). ELEMENTARY SPANISH.

For students with no previous creditable training in Spanish. Intensive practice in language skills. To fulfill the language requirement, upon completion of the course most students are required to continue by taking Spanish 130, 140. 3 class hours, 2 laboratory sessions.

126 (I), (II). ELEMENTARY SPANISH –
INTENSIVE.

Emphasis on the oral aspect. Designed to allow completion of Spanish 110 and 120 in one semester. 10 class hours. Open to all. *Credit, 6.*

130, 140 (I), (II). INTERMEDIATE SPANISH
(140:C).

For upperclassmen who have completed Spanish 110–120, and freshmen and transfer students found qualified by placement examination. Training in language skill, with emphasis on speaking and understanding; readings in cultural and literary texts. Students completing Spanish 140 fulfill the language requirement.

131 (I), 141 (II). GRAMMAR.

A review of basic elements of grammar. For Spanish majors and others who plan to continue with Spanish beyond Spanish 140. To be taken concurrently with Spanish 130 and 140. 2 class hours. *Credit, 1.*

132 (I), 142 (II). INTERMEDIATE SPANISH
(Honors Section) (142:C).

See Spanish 130, 140 for description.

133 (I), (II). INTERMEDIATE SPANISH
(Remedial).

See Spanish 130 for description. For students who are not fully qualified for placement in Spanish 130. 4 class hours.

134 (I), (II), 144 (I), (II). INTERMEDIATE
SPANISH (C).

Social sciences reading track.

146 (I), (II). INTERMEDIATE SPANISH –
INTENSIVE (C).

An intensive intermediate course. Emphasis on conversation in Spanish and readings in Hispanic literature. Systematic review of grammar. Successful completion of this course satisfies the foreign language qualification. 8 class hours. *Credit, 6.*

161 (I), 162 (II). INTRODUCTION TO SPANISH
LITERATURE (C).

Selected complete works in several genres studied analytically and critically to develop intensive reading skills and extend ability to interpret and explicate in Spanish both orally and in writing. Prerequisite, Spanish 140 or equivalent.

181 (I), 182 (II). ORAL SPANISH.

Oral aspects of the language: pronunciation, vocabulary building, speeches, discussions, debates. Grammatical elements required for correct and fluent use of American and Peninsular Spanish. Prerequisite, Spanish 140 or permission of department. 4 class hours.

190 (I). COMPOSITION.

Study and practice of the basic principles of writing in Spanish. Required of Spanish majors; open to others qualified. Prerequisite, Spanish 131, 141.

200 (I). CULTURAL BACKGROUNDS:
SPAIN (C).

The diverse factors that have shaped Spanish culture. In Spanish. Prerequisite, Spanish 140 or permission of instructor.

201 (II). CULTURAL BACKGROUNDS:
LATIN AMERICA (C).

The unity and diversity of Latin American civilization and the different cultural factors that have shaped it. In Spanish. Prerequisite, Spanish 140 or equivalent.

251 (I). CONVERSATIONAL SPANISH.
(Course 1)

For Spanish majors and others interested in developing fluency in the spoken language. Prerequisite, Spanish 181–182 or permission of department. *Credit, 1.*

252 (II). CONVERSATIONAL SPANISH.
(Course 2)

For Spanish majors and others interested in further fluency in the spoken language. Prerequisites, Spanish 181–182 and Spanish 251 or permission of department. *Credit, 1.*

253 (I). CONVERSATIONAL SPANISH.
(Course 3)

For Spanish majors and others interested in further fluency in the spoken language. Prerequisites, Spanish 181–182 and Spanish 251 and 252 or permission of department. *Credit, 1.*

254. CONVERSATIONAL SPANISH.

For Spanish majors and others interested in further fluency in the spoken language. Prerequisites, Spanish 181–182 and Spanish 251, 252 and 253 or permission of department. 2 class hours. *Credit, 1.*

290 (II). SPANISH MASTERPIECES
IN TRANSLATION (C).

Detailed study of masterpieces of Spanish literature from various periods. Not open to majors in Spanish nor to students who have taken or plan to take Spanish 161–162.

307. THE TEACHING OF SPANISH.

Analysis of the major problems anticipated in the teaching of Spanish, and their solutions.

308 (I). SPANISH PHONETICS: PHONOLOGY
AND PHONEMICS.

A systematic study of sounds, articulation and graphic representation. Highly recommended for teachers of Spanish.

309 (I). ADVANCED GRAMMAR.

Finer details and shades of Spanish grammar. Highly recommended for Spanish majors planning to teach; open to all qualified. Prerequisite, Spanish 131 and 141.

310 (I). ADVANCED COMPOSITION.

Intensive study of composition and style. Highly recommended for Spanish majors planning to teach; open to all qualified.

315. SPANISH LITERATURE FROM ITS
BEGINNINGS TO 1500.

Poema de mio Cid, Libro de buen amor, Celestina and other selected texts.

317. SPANISH MEDIEVAL POETRY.

Spanish epic, lyric poetry and other verse of the period.

318. SPANISH MEDIEVAL PROSE.

Narrative, historical and didactic prose works of medieval Spain.

325. PROSE OF THE GOLDEN AGE.

Major prose works in sixteenth and seventeenth century Spain. Emphasis on the novel, excluding the *Quijote*.

330. CERVANTES.

Intensive reading of *Don Quijote*.

335. LYRIC POETRY OF THE GOLDEN AGE.

Spanish poetry of the sixteenth and seventeenth centuries from Garcilaso to Gongora.

340. DRAMA OF THE GOLDEN AGE.

Deals primarily with the comedia during the period of maximum creation, 1556-1681.

355. SPANISH LITERATURE FROM 1700
THROUGH ROMANTICISM.

Spanish literature and thought in the eighteenth century and the Romantic movement.

365. NINETEENTH CENTURY SPANISH NOVEL.

Prose fiction in the second half of the nineteenth century.

370. SPANISH-AMERICAN LITERATURE
TO 1900.

A survey from pre-Columbian times to the Modernist movement.

371. THE MODERNISTA MOVEMENT.

Modernismo in Spanish America, including a comparative study of its manifestations in Spain.

372. MAJOR SPANISH-AMERICAN WRITERS.

Intensive study of major figures in Spanish-American literature.

373. SPANISH-AMERICAN POETRY AND
DRAMA SINCE MODERNISMO.

The principal authors and movements in the twentieth century.

374. MODERN SPANISH-AMERICAN
PROSE FICTION.

Spanish-American prose fiction in the late nineteenth and early twentieth centuries.

375. CONTEMPORARY PROSE FICTION IN
SPANISH AMERICA.

The recent novel and short story.

381. MODERN SPANISH THEATRE.

Development of the theatre in Spain from the post-Romantic period to the present.

382. TWENTIETH-CENTURY SPANISH PROSE
FICTION.

The novel in Spain from the Generation of '98 to the present.

383. MODERN SPANISH POETRY.

Poetry in Spain from Bécquer to the present.

384. THE ESSAY AS A LITERARY GENRE.

The essay as a vehicle for Spanish thought in the late nineteenth and twentieth centuries.

385, 386. SPECIAL PROBLEMS.

Individual study of a selected problem for qualified students. By arrangement with members of the department.
Credit, 1-3.

390. SENIOR SEMINAR.

Independent work on special problems in Hispanic literatures.

History

Chairman of Department: Professor Robert McNeal; Professors Albertson, Bernhard, Gordon, Greenbaum, Hanke, Ilardi, Kirk, Lewis, Oates, Potash, Quint, F. Wickwire; Associate Professors Boyer, Cantor, Chrisman, Davis, DePillis, Griffith, Hart, Hernon, Johnston, McFarland, Minear, Tager, Ware, Wyman; Assistant Professors Bell, Berkman, Drake, Frank, Jones, Loy, Nissenbaum, Pelz, Rearick, Richards, Sarti, Shipley, Swartz, Swenson, Thompson, VanSteenberg, M. Wickwire; Instructors Biddle, Bittel, Laurie, White; Lecturer Tragle.

History majors must take as required courses in their freshman and sophomore years two year-long sequences chosen from History 100-101 or 110-111, 115-116, 120-121, 140-141, 150-151. The history major will select one of five areas of specialization (European, British, American, Latin American, or East Asian history) and take within it a minimum of 15-18 credits of upper-level course work. Students specializing in European history will be required to include in their program at least 3 credits in ancient or medieval history and an additional 3 credits in the early modern period (from the Renaissance through the 18th century). An additional 6-9 credits in electives outside the area of specialization is required, for a total of at least 36 credits in lower and upper-level history courses.

100 (I), 101 (II). HISTORY OF WESTERN
THOUGHT AND INSTITUTIONS (C).

The historical development of the western European countries, their ideas, and institutions. Either semester may be elected independently. Admission to honors sections of these courses (102, 103) by permission of department.

102 (I), (II), 103 (I), (II). HONORS SECTION
OF HISTORY OF WESTERN THOUGHT
AND INSTITUTIONS (C).

106 (I), 107 (II). HONORS SEMINAR IN
MODERN EUROPEAN HISTORY (C).

A thematic approach to the history of Europe since 1715. Open to Commonwealth scholars and selected students.

110 (I), 111 (II). PROBLEMS IN WORLD
CIVILIZATION (C).

A comparative study of both the common and distinctive aspects of the world's great civilizations at critical phases of their development. Either semester may be elected independently.

115 (I), 116 (II). HISTORY OF EAST ASIAN
CIVILIZATION (C).

An introductory survey of China, Japan, and related regions. First semester: survey of Chinese history;

second semester: survey of Japanese history. Either semester may be elected independently. Staff.

120 (I) 121 (II). HISTORY OF LATIN AMERICAN CIVILIZATION (C).

An introduction to the history of Latin America. First semester: from pre-conquest times to the close of the colonial era; second semester: the evolution of Latin America in the nineteenth and twentieth centuries. Either semester may be elected independently.

140 (I), 141 (II). EUROPEAN HISTORY, 1500 TO THE PRESENT (C).

The historical development of Western European thought and institutions. First semester: from 1500 to 1815; second semester: 1815 to the present. History majors are strongly urged to take this course before registering for advanced European courses.

150 (I), 151 (II). THE DEVELOPMENT OF AMERICAN CIVILIZATION (C).

A survey of the American national growth. Either semester may be elected independently. Admission to honors sections of these courses (152, 153) by permission of department.

152 (I), 153 (II). HONORS SECTIONS OF THE DEVELOPMENT OF AMERICAN CIVILIZATION (C).

185 (I), 186 (II). NEW APPROACHES TO THE STUDY OF HISTORY (C).

Learning history by doing it. Each semester devoted to analysis of a single event; these have included the Salem witch trials and Shays' Rebellion. Either semester may be elected independently.

Mr. Boyer, Mr. Nissenbaum.

200 (I). THE ANCIENT WORLD TO 500 B.C. (C).

From origins of human society to the Greek confrontation with the Persian Empire.

Mr. Kirk.

201 (II). THE ANCIENT WORLD: PERICLES TO CONSTANTINE (C).

The successive assertions and breakdowns of leadership in the Greek and Roman worlds.

Mr. Kirk.

202 (I). EARLY MIDDLE AGES, 300-1100 (C).

Spread of Christianity; pagan and early Christian culture; Germanic kingship; the Carolingian world; early feudalism; monasticism and ecclesiastical centralization.

Mr. Ware.

203 (I). THE LATTER MIDDLE AGES, 1100-1350 (C).

Revival of towns and commerce; the growth and development of the feudal monarchies and ecclesiastical authority; rise of secularism.

Mr. Lewis, Mr. Ware.

205 (I), 206 (II). THE AGE OF THE RENAISSANCE AND REFORMATION, 1300-1600 (C).

The changes in European thought and institutions during the development of Humanism and the Protestant and Catholic Reformations. Either semester may be elected independently.

Mr. Ilardi.

207 (I). EUROPE IN THE ENLIGHTENMENT, 1685-1789 (C).

Civilization of western Europe in the eighteenth cen-

tury, its social milieu, intellectual setting, institutional forces, religious tendencies, aesthetic contributions, and the growth of the revolutionary spirit. Mr. Greenbaum.

208 (II). THE FRENCH REVOLUTION AND NAPOLEON (C).

Political change in Europe from the Old Regime and the French Revolution to the fall of Napoleon.

209 (II). HISTORY OF EUROPE, 1815-1870 (C).

Major developments in the internal and international affairs of the European states from the Congress of Vienna to the Franco-Prussian War.

Mr. Rearick.

210 (I). EUROPE, 1870-1918 (C).

Internal developments of the principal countries; conditions and diplomacy which led to the World War; military and diplomatic history of the war years.

Mr. VanSteenberg, Mr. Levy.

211 (II). EUROPE SINCE 1918 (C).

Major developments in the internal and international affairs of the European states since World War I.

Mr. VanSteenberg, Mr. Levy.

212 (I). EUROPEAN INTELLECTUAL HISTORY IN THE NINETEENTH CENTURY (C).

Chief intellectual currents in Europe; romanticism, liberalism, religious revival, socialism, Darwinism, racism, and mass culture.

Mr. Rearick.

213 (II). EUROPEAN INTELLECTUAL HISTORY IN THE TWENTIETH CENTURY (C).

Philosophical, academic, literary, aesthetic, political and popular currents since 1900. By permission of instructor.

Mr. Johnston.

214 (I), 215 (II). THE HISTORY OF RUSSIA (C).

A survey of Russian political, social, economic, and intellectual history from the ninth century to the present. First semester: the origin, growth, and development of Russia to 1815; second semester: the impact of modernization on Russia in the nineteenth and twentieth centuries. Either semester may be elected independently.

Mr. Jones.

216 (I). THE RUSSIAN REVOLUTION (C).

Origins, course, and impact of the Bolshevik Revolution.

Mr. McNeal.

217 (II). SOVIET RUSSIA (C).

Major social, political, intellectual developments, and the international relations of Soviet Russia since the Bolshevik Revolution.

Mr. McNeal.

218 (I). EARLY MODERN GERMANY (C).

From the end of the Thirty Years' War to the collapse of the Napoleonic hegemony.

Mr. Gordon.

219 (II). THE HISTORY OF MODERN GERMANY (C).

The evolution and development of Germany since The Congress of Vienna, with emphasis upon diplomatic, political, military and social-economic trends and problems.

Mr. Gordon.

220 (I). MODERN SCANDINAVIA (C).

The major issues of domestic and foreign politics of the states of northern Europe in the nineteenth and twentieth centuries.

Mr. VanSteenberg.

221 (II). FRANCE SINCE 1789 (C).

Selected, formative political crises from 1789 to the present, and their settings in the economic, social, and intellectual life of modern France. Mr. Rearick.

222 (I). IMPERIAL SPAIN, 1450-1810.

Early modern Spain from the time of Ferdinand and Isabella to the outbreak of the Spanish American wars for independence; including the Hapsburg and early Bourbon periods.

223 (II). MODERN SPAIN, 1810 TO THE PRESENT.

Economic, political, and cultural developments from the early nineteenth century revolutions and the defeat of Napoleon to the age of Franco.

224 (I). EUROPEAN DIPLOMATIC HISTORY, 1870-1914 (C).

The internal politics and foreign policies of the major European powers. Emphasis on nationalism, liberalism, imperialism, alliance systems, and the origins of World War I. Mr. Swartz.

225 (II). EUROPEAN DIPLOMATIC HISTORY, 1914-1956 (C).

The internal politics and foreign policies of the major European powers. Emphasis on the importance of World War I, the polarization of national and international politics, the origins, course, and aftermath of World War II, and the post-war world. Mr. Swartz.

227 (I). MILITARY HISTORY OF MODERN EUROPE (C).

Development of European military theory and practice from the Napoleonic era to the present. Mr. Gordon.

228 (II). SEVENTEENTH CENTURY EUROPE (C).

Europe from the Wars of the Counter-Reformation to the Glorious Revolution. Civilization of the Baroque in its social, political, economic, religious and intellectual settings. Mr. Greenbaum.

229 (II). SOCIAL HISTORY OF EARLY MODERN EUROPE (C).

The social institutions of Europe as they change from a system of feudal organization to pre-industrial society, including the evolution of the town to the city, the changing role of the church, the changing role of agrarian life, the development of an intellectual class. Mrs. Chrisman.

230 (II). HISTORY OF MODERN ITALY (C).

From the origins of the *Risorgimento* in the eighteenth century to the "opening to the left" of the 1960's, with particular reference to domestic problems after the unification, to Italian foreign policy up to the Second World War, and to the rise and consolidation of fascism. Mr. Sarti.

231 (I), 232 (II). ENGLISH HISTORY (C).

Emphasis on economic, social, and cultural influences, as well as on constitutional development. Either semester may be elected independently.

Mr. Hernon, Mr. Shipley.

233 (II). MEDIEVAL ENGLAND (C).

England from the fifth to the fifteenth century, with particular attention to the Anglo-Saxon period, the Norman Conquest, and the evolution of government to the accession of the Tudors. Mr. Ware.

234 (I), 235 (II). TUDOR-STUART ENGLAND, 1485-1688 (C).

Selected aspects of the constitutional, social, intellectual, and imperial history of England in this period. Either semester may be elected independently.

Mr. Shipley.

236 (I). BRITAIN IN THE EIGHTEENTH CENTURY (C).

Selected aspects of social, intellectual, imperial, and constitutional history, including the Acts of Union. Impact of the Industrial and French Revolutions.

Mr. Wickwire.

237 (I), 238 (II). MODERN BRITAIN (C).

Selected topics on the political, social, and intellectual development of Britain in the nineteenth and twentieth centuries. Either semester may be elected independently.

Mr. Hernon, Mrs. Berkman.

239 (II). HISTORY OF THE BRITISH EMPIRE AND COMMONWEALTH SINCE 1783 (C).

Evolution of British imperial policy; growth of the Dominions, the Commonwealth, and the dependent Empire; role of the Empire in world politics.

Mr. Wickwire.

240 (I). SOCIAL HISTORY OF EUROPE SINCE THE FRENCH REVOLUTION (C).

The appearance, disappearance, rise and fall and alteration of social classes and major subclasses during the period. The causes and results of such developments. The interrelationships of political, economic, and social developments; differences of social systems within the European framework and their reverberations.

Mr. Gordon, Mr. Sarti.

301 (II). ARGENTINA IN THE NINETEENTH AND TWENTIETH CENTURIES (C).

The emergence of the major South American states. Political organization and economic change; the contemporary growth of nationalism and mass-based political movements.

Mr. Potash.

302 (I). THE HISTORY OF MEXICO (C).

Mexico from the end of the eighteenth century to the present. Emphasis on political, economic, and social developments.

Mr. Potash.

303 (I). THE CARIBBEAN (C).

The Caribbean as a focus of conflict and adjustment from the fifteenth century to the present.

Mrs. Loy.

304 (II). HISTORY OF GRAN COLOMBIA (C).

Colombia, Venezuela and Ecuador from colonial settlement to the present.

Mrs. Loy.

305 (II). HISTORY OF THE ANDEAN REPUBLICS (C).

Peru, Bolivia, and Chile from the late colonial period to the present. Emphasis on political, social and economic developments with particular attention to institutions.

307 (I). THE HISTORY OF THE PORTUGUESE EMPIRE (C).

The colonial empire Portugal created in Morocco, West Africa, Mozambique, India, Brazil, and the Far East — from the capture of Ceuta in 1415 until Portugal recognized the independence of Brazil in 1825. Comparative treatment of economic affairs, political institutions, race relations, and cultural developments. A one-semester course.

Mr. White.

308 (II). THE HISTORY OF BRAZIL (C).

The cultural, economic, and political development of Brazil since 1822. How the largest and most populous nation in Latin America has become a significant power. A one-semester course. Mr. White.

316 (I). AMERICAN COLONIAL HISTORY TO 1763 (C).

Discovery and exploration; early European settlements; system of political and economic control; religious and intellectual development; Anglo-French rivalry.

Mr. Bernhard, Mr. Bell.

317 (II). THE AMERICAN REVOLUTIONARY ERA (C).

Coming of the Revolution; War for Independence; evolution of American federalism.

Mr. Bernhard, Mr. Bell.

318 (II). THE EARLY NATIONAL PERIOD, 1789-1828 (C).

The development of the United States in its formative years, emphasizing political, intellectual, and diplomatic factors.

Mr. Bernhard.

319 (I). JACKSONIAN AMERICA (C).

Political, economic, and social developments in the period before the Civil War.

Mr. Richards.

320 (I). CIVIL WAR AND RECONSTRUCTION, 1860-1877 (C).

Conduct of the war; political problems; national reunification.

Mr. Oates, Mr. Swenson.

321 (II). THE GILDED AGE (C).

The emergence of modern political issues during the final decades of the nineteenth century. Emphasis on the role of industrialization, corporate consolidation, urban growth, and labor, agrarian, and genteel protests.

Mr. McFarland.

324 (I). THE PROGRESSIVE AGE, 1900-1920 (C).

The political response to the changing economic and social conditions in American life.

Mr. Thompson, Mr. Tager.

325 (II). THE UNITED STATES BETWEEN THE WORLD WARS, 1920-1925 (C).

American political, economic, and intellectual life between the two World Wars.

Mr. Griffith, Mr. Wyman.

326 (I), 327 (II). HISTORY OF AMERICAN THOUGHT AND CULTURE (C).

The basic strands of American thought and their reflection in American culture. First semester; the period before 1865. Either semester may be elected independently.

Mr. Quint, Mr. Cantor,

Mr. Boyer, Mr. Nissenbaum.

328 (I). UNITED STATES CONSTITUTIONAL HISTORY TO THE CIVIL WAR (C).

Origins and development of American constitutionalism from the seventeenth century to the outbreak of sectional armed conflict.

Mr. Cantor.

329 (II). UNITED STATES CONSTITUTIONAL HISTORY FROM THE CIVIL WAR TO THE PRESENT (C).

Evolution of constitutional power in modern America.

Mr. Cantor.

330 (I), 331 (II). SOCIAL HISTORY OF THE UNITED STATES (C).

The evolving status of individuals and groups and problems of migration, livelihood, urbanization, and social conflict. Either semester may be elected independently.

Mr. DePillis.

332 (I). THE SOUTH IN AMERICAN HISTORY (C).

From early settlement to contemporary regional problems.

Mr. Thompson.

333 (II). HISTORY OF AMERICAN WESTWARD EXPANSION, 1763-1893 (C).

Advance of settlement from the Appalachians to the Pacific and the influence of the frontier upon social, economic, and political conditions.

Mr. Davis, Mr. DePillis.

334 (I), 335 (II). DIPLOMATIC HISTORY OF THE UNITED STATES (C).

Development of American foreign relations, 1776 to the present. Either semester may be elected independently.

Mr. Hart, Mr. Pelz.

336 (II). HISTORY OF THE AMERICAN LABOR MOVEMENT (C).

Evolution of trade unionism in American life from late eighteenth century origins through post-Civil War developments to the present. Critical evaluation of changes in labor history.

Mr. Laurie.

337 (II). THE CITY IN THE MODERN UNITED STATES (C).

The industrial city and the full-scale urbanization of the modern United States. Effect of city life on the social, political and economic institutions of America. Emphasis on the historical origins of the problems of modern urban existence.

Mr. Tager.

339 (II). UNITED STATES SINCE PEARL HARBOR (C).

Emphasis on political, economic, and social currents since World War II.

Mr. Griffith, Mr. Wyman.

340 (I). CIVILIZATION OF ISLAM (C).

From the "revolutionary idea" of Islam and its conquest of an Arab empire to eighteenth century decay and the Western challenge.

Mr. Biddle.

341 (II). THE MODERN MIDDLE EAST (C).

From the impact of eighteenth century Europe on the Islamic empire to the emergence of twentieth century Arab nationalism and socialism and the decline of Western influence.

Mr. Biddle.

342 (II). THE OTTOMAN EMPIRE (C).

Ottoman history and institutions from the origins of the state to the proclamation of the Turkish Republic, ca. 1280 to 1923. Emphasis on political, economic and social history and the problems of westernization.

360 (I). HISTORY OF MODERN CHINA TO 1900 (C).

Explores the nature of the "traditional" Chinese order inherited by China's alien Manchu rulers; China's response to the West; rise of rebellions; failure of conservative reform; disintegration of an ancient civilization. Prerequisite, History 115 and 116 or permission of instructor.

Mr. Drake.

361 (II). HISTORY OF MODERN CHINA:
THE TWENTIETH CENTURY (C).

Examines twentieth century China's revolutions – intellectual, social, economic, political – and their settings up to the present. Prerequisite, History 115 and 116 or permission of instructor. Mr. Drake.

362 (I). HISTORY OF JAPANESE CIVILIZATION
(C).

The development of Japanese civilization from its origins to the mid-nineteenth century. Mr. Minear.

363 (II). HISTORY OF MODERN JAPAN (C).

Japan's modernization from the mid-nineteenth century. Mr. Minear.

370 (I), 371 (II). HISTORY OF SCIENCE (C).

Development of major scientific achievements from antiquity to the present. Emphasis on scientific theory; conceptual developments in philosophical, cultural, sociological and scientific contexts. Prerequisite, one year of physical science. Mr. Frank.

386 (I), (II). SPECIAL TOPICS.

Special topics to be arranged, chiefly for advanced history majors. Staff.

395 (I), (II). SENIOR SEMINAR.

For seniors specializing in history. Intensive study in area of specialization, with emphasis on research papers. Staff.

399 (I), (II). SENIOR HONORS.

Honors Program

Acting Director: Prof. W. Brian O'Connor.

Honors Program courses are usually open only to Commonwealth Scholars in the Honors Program.

181 (I), 182 (II), 183 (I), 184 (II), 185 (I),
186 (II). HONORS – STUDIES IN THE
HUMANITIES (C).

An area of one or more of the humanistic disciplines, such as art, literature, music, history, or philosophy. For Honors Program freshmen and sophomores, and others by permission of the Director of Honors.

187 (I), 188 (II), 189 (I), 190 (II), 191 (I),
192 (II). HONORS – STUDIES IN THE
SOCIAL SCIENCES (D).

An area of one or more of the social sciences, such as economics, psychology, sociology, or anthropology. For Honors freshmen and sophomores, and others by permission of the Director of Honors.

193 (I), 194 (II), 195 (I), 196 (II), 197 (I),
198 (II). HONORS – STUDIES IN THE
SCIENCES AND MATHEMATICS (E).

An area of one or more of the sciences, such as physics, chemistry, botany, astronomy, geology, or zoology, or of mathematics. For Honors Program freshmen and sophomores, and others by permission.

385 (I), 386 (II). HONORS-INTERDISCIPLINARY
STUDIES: JUNIOR COLLOQUIUM.

An interdisciplinary seminar for Honors Program juniors, open by invitation only.

387 (I), 388 (II). HONORS-INTERDISCIPLINARY
STUDIES: SENIOR COLLOQUIUM.

An interdisciplinary seminar for Honors Program seniors, open by invitation only.

391 (I), 392 (II), 393 (I), 394 (II). HONORS –
INTERDISCIPLINARY SEMINAR.

Study through the seminar method of a problem requiring the use of several disciplines. For Honors Program juniors and seniors, and others by permission.

Latin American Studies

Undergraduates interested in Latin America may enroll in the Latin American Studies Program. The Program does not constitute a major and is designed to supplement the work done in a regular discipline. However, those students who fulfill the requirements of the Program will be awarded the Certificate in Latin American Studies attesting to their attainment in area and language studies. To earn a certificate a student must 1) satisfactorily demonstrate a practical working knowledge of Spanish or Portuguese and elementary proficiency in the other, 2) satisfactorily complete four courses focused on Latin America, and 3) participate in the Inter-disciplinary Seminar on Latin America. The requirements of the Program are to be met partly through courses that fulfill existing requirements of the College and partly through the careful use of electives.

The Committee on Latin American Studies administers the Program and advises interested students. Members of the Committee are: P. Barreda-Tomas (Hispanic Languages and Literatures); M. Best (Economics); R. A. Potash, Chairman (History); D. Proulx (Anthropology); H. Wiarda (Political Science); R. Wilkie (Geography).

390 (II). INTERDISCIPLINARY SEMINAR ON
LATIN AMERICA.

Topics in modern and contemporary Latin America. For Certificate Program seniors and others who have completed at least three courses representing at least two different disciplines on Latin America and have a reading knowledge of either Spanish or Portuguese.

392(I). BIBLIOGRAPHY OF LATIN AMERICAN
STUDIES.

A survey and evaluation of sources of information about Latin America. Interdisciplinary approach. For Certificate Program students and others with strong interest in Latin America. Reading knowledge of either Spanish or Portuguese is required.

Linguistics

Chairman of Department: Associate Professor Donald C. Freeman; Associate Professor Partee; Assistant Professors Akmajian, Demers, Heny, Heringer, Peterson; Instructor Vetter.

Although there is no undergraduate major in Lin-

guistics, courses are offered for those wishing to prepare for graduate work in this field or in anthropology, computer science, English, the foreign languages, philosophy, or speech. In addition to the courses listed below, many other departments offer related courses.

201 (I), (II). GENERAL LINGUISTICS (C).

A comprehensive treatment of the field of linguistics. The nature of language. Some language universals. Phonology, syntax, and other aspects of modern language theory. By permission may be counted for major credit in English, German, Romance Languages, Speech, and Psychology. Mr. Freeman.

202 (I), (II). PHONOLOGICAL THEORY (C).

Introduction to the theoretical and psychological bases of contemporary phonological analysis; the concepts of the distinctive feature analysis. Prerequisite, Ling 201 or permission of instructor. Mr. Demers.

203 (I), (II). SYNTAX (C).

Methods of word and sentence formation; the notions of grammatically and well-formed utterances. Prerequisite, Ling 201 or permission of instructor. Mr. Heny.

204 (II). FIELD METHODS.

The methodology of linguistic work in the field; preparing questionnaires; analysis of data; use of the tape recorder. Prerequisite, permission of instructor. Mr. Heny.

323 (II). THE STUDY OF THE NATIVE LANGUAGE.

Historical backgrounds for the teaching of English language; comparative analysis of modern theories of grammar; the uses of English; dialect and register; the language of literature. Mr. Freeman.

Related Courses

ANTHROPOLOGY 105.

ENGLISH 312; 321.

GERMAN 259; 266.

PHILOSOPHY 125; 281; 282.

PSYCHOLOGY 221.

SLAVIC LANGUAGES 263; 265.

SPEECH 181; 284.

Mathematics and Statistics

Acting Head of Department: Professor Haskell Cohen.

Mathematics Faculty: Professors Marshall H. Stone (George David Birkhoff Chair of Mathematics), Chen, Cullen, Fischer, Foulis, Holland, Jacob, Janowitz, Koch, Kundert, Mann, Martindale, Strother, Wagner, Wang, Whaples; Associate Professors Allen, Dickinson, Eisenberg, Fogarty, Hayes, Knightly, Lavalley (Associate Head), Liu, Randall, Su; Assistant Professors Adams, Bennett, Borrego, Broshi, Bussel, Catlin, Chang, Connors, Cook, Douglass, Gauger, Gleit, Hedlund, Hertz, Hurt, Joiner, S. Jones, Killam, King, H.-T. Ku, M.-C. Ku, Mandelbaum, Manes, McGuigan,

Morash, Naylor, Norman, Reed, Salter, Sicks, Shafer, St. Mary, Stockton, Storey, Wattenberg; Instructors R. Jones, Maecher (Administrative Head), Malone, Maulucci, Neenan; Lecturers Cade, Desmarais, Gorfin, Jeffcott, Moynihan, Nutt, D. Stenson, E. Stenson, Symancyk, Wakin, White, Will, Wright.

Statistics Faculty: Professors Oakland, Schweizer, Skibinsky (Vice Chairman); Associate Professor Rosenkrantz; Assistant Professors Dahiya, Geman, Horowitz, Kleyle, Lew.

MATHEMATICS

Beginning with the Class of 1975, the requirements for a major in mathematics are the successful completion of: 1) Mathematics 165 (or 166) and 167; 2) a two-semester sequence in each of two of the groups Algebra, Analysis, Applied Mathematics, Geometry listed below; 3) one course in a third of these four groups; 4) three additional upper-division courses in mathematics or related fields (including statistics, mathematical logic, and computer science) — a list of specific math-related courses which may be used to satisfy this requirement will be found in the Mathematics Information Leaflet; 5) two courses in engineering or in some one physical or biological science. In addition, a major is expected to have a cumulative quality point average of at least 2.0 in all courses numbered 167 and above taken at the University and used to satisfy these major requirements.

The Algebra group is 211-212 and 311-312. The Analysis group is 225-226, 233, 325-326, 331-332 (or 331-334). The Applied Mathematics Group is 241-242, 251-252, 257, 345-346. The Geometry group is 261-262, 363, 365-366. The two-semester sequences in this list which may be used to satisfy major requirement 2), above, are those pairs marked with a hyphen.

Mathematics majors in the Classes of 1973 and 1974 may elect to satisfy either the new requirements or else the prior requirements through the successful completion of: 1) Mathematics 174 (or 184); 2) Mathematics 200, 211-212, and 225 (or 325); 3) four additional upper-division courses in mathematics, exclusive of Mathematics 285 and 286 (one or two of these may be replaced by math-related courses which would satisfy the new requirement 4), above); 4) two courses in some one science.

Further information, including suggested programs for particular interests, appears in the Mathematics Information Leaflet, obtainable from the Department Office.

011. ELEMENTARY COLLEGE ALGEBRA.

For those students who offer only one unit of algebra for entrance. A review of elementary algebra and a more thorough study of such topics as quadratic equations, exponents and radicals. *No Credit.*

100. MATHEMATICS IN THE MODERN WORLD (E).

A cultural and historical presentation of some mathematical ideas, to demonstrate both the scientific and the humanistic values. Open to Mathematics majors for non-major elective credit.

110. ELEMENTARY TECHNIQUES OF MATHEMATICS (E).

Including sets, logic, numbers, counting, functions, and graphs. Credit not allowed those who have taken the former course Math 111, Math 112, or any calculus course.

112. FINITE MATHEMATICS (E).

Probability, vectors and matrices, and an introduction to linear programming. Prerequisites, Math 110 or equivalent.

115. ELEMENTARY LINEAR ALGEBRA (E).

Systems of linear equations. Vector spaces, with emphasis on Euclidean spaces. Linear transformations and matrices. Determinants. Characteristic vectors. Designed as an elective for students in the School of Business Administration, Industrial Engineering, Economics. Credit not allowed for this course after Math 167 or Math 212.

116. CALCULUS FOR BUSINESS I (E).

Sets, real numbers, inequalities, relations and functions, sequences, series, limits, differentiation and applications. Credit given for only one of the courses 113, 116, 118, 122, 123, 131, 133, 135, 137, 153.

117. CALCULUS FOR BUSINESS II (E).

Functions of several variables, maxima and minima, exponential and logarithmic functions, integration, introduction to differential equations. Credit given for only one of the courses 117, 119, 124, 125, 132, 134, 136, 138, 154. Prerequisite, Math 116/118.

118. MATHEMATICS 116 REMEDIAL (E).

Same topics as Math 116, plus remedial work as needed. Credit given for only one of the courses 113, 116, 118, 122, 123, 131, 133, 135, 137, 153. 4 class hours.

119. MATHEMATICS 117 REMEDIAL (E).

Same topics as Math 117, plus remedial work as needed. Credit given for only one of the courses 117, 119, 124, 125, 132, 134, 136, 138, 154. Prerequisite, Math 116/118. 4 class hours.

130. PRECALCULUS MATHEMATICS (E).

Functions and graphs; analytic geometry of lines and conic sections; polynomial, exponential, logarithmic, and trigonometric functions. Primarily for students intending to study calculus but needing extensive preparation in the requisite algebra, trigonometry, and analytic geometry.

131. CALCULUS WITH PRECALCULUS I (E).

Introduction to differential and integral calculus of functions of a single variable with requisite analytic geometry and trigonometry: analytic geometry of lines and conic sections, trigonometric function, continuity, derivatives, extrema, curve sketching, the integral. Intended for students who are not prepared for Math 135 but who need less preparation than Math 130. Credit

given for only one of the courses 113, 116, 118, 122, 123, 131, 133, 135, 137, 153. Prerequisite, high school algebra and plane geometry. 4 class hours. *Credit, 4.*

132. CALCULUS WITH PRECALCULUS II (E).

Continuation of Math 131. Integration techniques, limits, partial derivatives, integrals as limits, improper integrals, theorems of Cauchy and Taylor, infinite series and power series, smooth curves. Credit given for only one of the courses 117, 119, 124, 125, 132, 134, 136, 138, 154. Prerequisite, Math 131/135. 4 class hours. *Credit, 4.*

135. CALCULUS I (E).

Introduction to differential and integral calculus of functions of a single variable: continuity, derivatives, extrema, curve sketching, the integral, elementary integration techniques. Primarily for students in the sciences. Credit given for only one of the courses 113, 116, 118, 122, 123, 131, 133, 135, 137, 153. Prerequisites, high school algebra, plane geometry, trigonometry, and analytic geometry of lines and conic sections, or Math 130.

136. CALCULUS II (E).

Continuation of Math 135. Limits, partial derivatives, integration techniques, integrals as limits, improper integrals, theorems of Cauchy and Taylor, infinite series and power series, smooth curves. Credit given for only one of the courses 117, 119, 124, 125, 132, 134, 136, 138, 154. Prerequisite, Math 135/137.

137. HONORS CALCULUS I (E).

An enriched version of Math 135 for those wishing a deeper knowledge of the subject matter. Graded by the standards of Math 135. Credit given for only one of the courses 113, 116, 118, 122, 123, 131, 133, 135, 137, 153. Prerequisites, some demonstrated mathematical aptitude and permission of department.

138. HONORS CALCULUS II (E).

An enriched version of Math 136 for those wishing a deeper knowledge of the subject matter. Graded by the standards of Math 136. Credit given for only one of the courses 117, 119, 124, 125, 132, 134, 136, 138, 154. Prerequisites, some demonstrated mathematical aptitude, Math 135/137, and permission of department.

141. MATHEMATICS OF FINANCE (E).

The mathematical principles of simple and compound interest, annuities, depreciation, valuation of bonds, and insurance.

146. SURVEY OF CALCULUS (E).

Differentiation, integration, and applications. Not recommended for students who can take a more complete course in calculus. Credit given for only one of the courses 113, 116, 118, 122, 123, 131, 133, 135, 137, 146, 153. Prerequisites, Math 110 or equivalent.

151. BASIC CONCEPTS OF ALGEBRA (E).

The real numbers as a field. Linear and quadratic equations and inequalities. Systems of linear equations and inequalities. Congruence. Complex numbers. Polynomials. Algebraic structures. Functions. Highly recommended for prospective elementary school teachers. Credit not allowed for Math 151 after Math 211. Prerequisite, Math 110 or equivalent.

165. MULTIVARIABLE CALCULUS (E).
Functions of several variables, partial derivatives, multiple integrals, theorems of Green, Stokes, and Gauss. Prerequisite, Math 173/183 or Math 132/136/138.

166. HONORS MULTIVARIABLE CALCULUS (E).
An enriched version of Math 165, for those wishing a deeper knowledge of the subject matter. Graded by the standards of Math 165. Prerequisites, Math 138 or Math 183, and permission of department.

167. INTRODUCTION TO LINEAR ALGEBRA (E).
Vector spaces over the real field, linear independence, linear equations, bases and dimension, inner product spaces, linear transformations and matrices, determinants, eigenvalues, applications to geometry. Not for credit after Math 212. Corequisite, 2nd semester of calculus.

187. ORDINARY DIFFERENTIAL EQUATIONS FOR SCIENTISTS AND ENGINEERS (E).
First and second order equations, elementary theory of Laplace transforms, systems with constant coefficients. Not for credit after Math 331 or 343. Prerequisite, Math 173/183 or Math 132/136/138. Math 165/166 recommended as a corequisite.

200. FUNDAMENTAL CONCEPTS OF MATHEMATICS (E).
Non-axiomatic propositional calculus (with truth tables), basic quantification theory and set algebra. Binary relations, equivalence relations, partitions, functions. Development of basic algebraic and topological features of real numbers from the axioms for a complete ordered field. Prerequisite, permission of instructor.

211. INTRODUCTION TO MODERN ALGEBRA I (E).
Introduction to groups, rings, and fields. Prerequisite, Math 167 or Math 200.

212. INTRODUCTION TO MODERN ALGEBRA II (E).
Continuation of Math 211. Finite dimensional vector spaces, linear transformations, elementary theory of matrices and determinants. Prerequisite, Math 211.

221 (I). VECTOR ANALYSIS.
The algebra and calculus of vectors with applications to physics and other fields. Prerequisite, Math 174/184.

225. ADVANCED CALCULUS I (E).
Elementary topology of the line and Euclidean n -space, continuous functions, Riemann integration, infinite series and power series. Not for credit after Math 325. Prerequisite, Math 165/166 or Math 174/184. Math 167 recommended.

226. ADVANCED CALCULUS II (E).
Continuation of Math 225. Multivariate analysis and the theorems of Green, Gauss, and Stokes. Not for credit after Math 326. Prerequisite, Math 225.

233. PROBABILITY.
A postulational study of probability, including counting methods, random variables; additional topics chosen

from Bayes' theorem, statistical independence, laws of large numbers, and Markov processes. Corequisite, Math 174/184 or Math 165/166.

241. APPLIED ANALYSIS I.
Complex analysis including analytic functions, residues, and conformal mappings; superposition of solutions of linear differential equations; orthogonal functions and Fourier series. Prerequisite, Math 174/184 or Math 165/166.

242. APPLIED ANALYSIS II.
Continuation of Math 241. Properties of Fourier series; boundary value problems; orthogonal functions; Laplace and Fourier transforms; applications to physical and engineering sciences. Prerequisite, Math 241; differential equations and a year of physics desirable.

251. NUMERICAL ANALYSIS I.
A first course in techniques of numerical approximation in analysis and algebra. Not for credit after Computer Science 251. Prerequisites, Math 174/184 or 165/166, and Comp Sci 121 or 131 or knowledge of basic FORTRAN.

252. NUMERICAL ANALYSIS II.
Continuation of Math 251, including numerical solution of partial differential equations. Prerequisite, Math 251.

257. LINEAR PROGRAMMING AND THEORY OF GAMES.
The Simplex Method and extensions, duality theorems, transportation problems and other applications. Finite two-person zero-sum games and the fundamental theorem. Prerequisite, junior-senior standing in Mathematics or permission of instructor.

261. AFFINE AND PROJECTIVE GEOMETRY I.
Coordinationization of the Desarguesian affine plane, the projective plane as an extension of the affine plane. Highly recommended for prospective secondary school mathematics teachers. Prerequisite, permission of instructor.

262. AFFINE AND PROJECTIVE GEOMETRY II.
Continuation of Math 261. Topics from affine, projective, Euclidean, and non-Euclidean geometry. Prerequisite, Math 261.

271. THEORY OF NUMBERS.
Euclidean algorithm, prime numbers, congruences, quadratic reciprocity, further topics in number theory. Recommended for prospective high school mathematics teachers. Prerequisite, Math 167 or Math 200, or permission of instructor.

275. TOPICS IN THE HISTORY OF MATHEMATICS.
A detailed examination of the work of a single great mathematician, the mathematics of a single historical period, or the historical development of a single mathematical idea. Prerequisite, Math 174/184 or Math 165/166.

311. THEORY OF GROUP REPRESENTATIONS (E).
Abstract groups, subgroups, quotient groups, homomorphisms, representations, irreducible representations,

characters, orthogonality relations. Intended for students qualified to study algebra at a significantly higher level of abstraction than Math 211. Prerequisites, Math 212 and permission of department.

312. ADVANCED TOPICS IN ALGEBRA (E).
Topics to be chosen from: rings, integral domains, modules over principal ideal domains, field extensions, and Galois theory. Prerequisite, Math 311, or Math 211 and permission of instructor.

325. INTRODUCTORY MODERN ANALYSIS I (E).
Basic topology of Euclidean n -space and metric spaces, convergence of sequences and series, continuous functions and their local and global properties. Prerequisites, Math 174/184 or Math 165/166, and Math 200.

326. INTRODUCTORY MODERN ANALYSIS II (E).
Continuation of Math 325. Differentiation, Riemann integration, sequences and series of functions, functions of several variables. Prerequisite, Math 325.

331. ORDINARY DIFFERENTIAL EQUATIONS.
First and second order equations, existence and uniqueness theorems, systems of equations. Prerequisites, Math 174/184 or Math 165/166.

332. TOPICS IN ORDINARY DIFFERENTIAL EQUATIONS.
Topics chosen from: Sturm-Liouville theory, series solutions, stability theory and singular points, numerical methods, transform methods. Prerequisite, Math 331.

334. INTRODUCTION TO PARTIAL DIFFERENTIAL EQUATIONS.
Classification of second order partial differential equations, wave equation, Laplace's equation, heat equation, separation of variables. Prerequisites, Math 174/184 or Math 165/166, and Math 331 or Math 343 or the grade of A or B in Math 187.

345. LINEAR ALGEBRA FOR APPLIED MATHEMATICS.
Introduction to vector spaces, inner products, and matrices followed by study of linear transformations, tensors, determinants, orientation, the spectral theorem for normal operators, complexification, real normal operators, and exterior algebra.

346. VECTOR AND TENSOR ANALYSIS WITH APPLICATIONS.
Continuation of Math 345. Fréchet derivatives, the inverse and implicit function theorems, vector and tensor fields, exterior differentiation, differential forms, differentiable manifolds. Prerequisites, Math 345, and Math 165/166 or Math 174/184.

363. DIFFERENTIAL GEOMETRY.
Differential geometry of curves and surfaces in Euclidean 3-space using vector methods. Prerequisite, Math 212 or permission of instructor.

365. TOPOLOGY I.
Introduction to the topology of metric spaces and topological spaces: metrics, topologies, continuity, connect-

edness, compactness. Prerequisite, Math 225, or Math 325, or permission of instructor.

366. TOPOLOGY II.
Introduction to the geometric ideas behind algebraic topology. Polyhedra, manifolds, Jordan curve theorem, homology mod 2, classification of surfaces, Brouwer fixed-point theorem. Prerequisites, Math 211 or 311, and Math 365.

371. SET THEORY.
Basic properties of sets. Ordered sets. Complete ordered sets. Well-ordered sets. Cardinal and ordinal numbers. Axiom of choice, well-ordering theorem, and Zorn's lemma. Cardinal arithmetic. Highly recommended for continuing mathematics majors. Prerequisite, permission of instructor.

385, 386, 387, 388. SPECIAL PROBLEMS.
Individual study of a selected problem for qualified students. By arrangement with members of the department. *Credit, 1-3.*

399. SENIOR HONORS.

STATISTICS

There is no undergraduate major in statistics. The curriculum is intended for those who wish to prepare themselves for graduate work in statistics and for those who require statistics as a basic preparation for their own subject-matter discipline. Cognate courses are needed to supply a basis for mature thinking. The statistical specialist should choose, according to his interests, cognate courses from such fields as: animal and plant breeding, biology, computer science, econometrics, engineering, genetics, mathematics, market research, psychology, and sociology. Students who expect to do graduate work in statistics should take Statistics 315 and 316.

Statistics leans heavily on mathematics and most of the prerequisites for the advanced statistics courses will come from Math 174/184, or Math 165/166 (calculus), Math 343 or Math 331 (differential equations), and a course in matrix algebra such as Math 167 or Math 212.

121 (I), (II). ELEMENTARY STATISTICS (E).
Selected topics in elementary probability and statistics: discrete models for chance experiments, conditional probabilities; "odds" and betting schemes, combinatorics, averages and standard deviation, random sampling, binomial and normal distributions, regression, statistical inference, chi square test. Students who intend to use statistics as a research tool, but who do not have a calculus background, should elect Stat 231, 232. Students with calculus background should elect Stat 315, 316.

231. INTRODUCTION TO FUNDAMENTALS OF STATISTICAL INFERENCE I (E).
Random experiments and probability models; independence; conditional probability; sampling; random variables; data representations; special distributions, deduction and inference.

232. INTRODUCTION TO FUNDAMENTALS OF STATISTICAL INFERENCE II (E).

Point, interval and model estimation; hypothesis testing; optimality concepts; power; least squares techniques; decision theoretic notions. Prerequisite, Stat 231.

251 (II). ELEMENTARY LEAST SQUARES, REGRESSION, AND ANALYSIS OF VARIANCE (E).

Analysis of variance; design of experiments; sample surveys, multiple regression, non-parametric tests. Not open to students who have completed Stat 315 or Psych 245. Prerequisite, Stat 121 or 232.

261 (I). DESIGN OF EXPERIMENTS (Methods). Purpose of experimental designs and their basic assumptions; individual comparisons, components of error, confounding; applications from various fields. Prerequisite, Stat 121, 232, or 316.

262 (II). ADVANCED STATISTICAL ANALYSIS OF EXPERIMENTAL DATA.

Analysis of data with disproportionate subclass numbers. Includes the method of fitting constants, the method of weighted squares of means, absorption of equations, expectations of mean squares, and tests of hypotheses. Prerequisite, Stat 261.

271 (I). SURVEY SAMPLING.

Theory and practice of sampling; optimum allocation of resources, estimation of sample size, various sampling methods, ratio and regression estimates, problem of non-response. Prerequisite, Stat 121, 232, or 316.

272 (II). SAMPLING THEORY AND METHODS. Problems and methods of samplings; production and quality control, acceptance sampling, OC and ASN curves, types and properties of estimators. Prerequisite, Stat 121, 232, or 316.

281 (II). MULTIVARIATE ANALYSIS (Methods). Applications of the theory in Statistics 282 to actual problems; research studies by the students, critiques of published research, or analysis of other bodies of data. Prerequisite, Stat 251 or 316.

282 (II). MULTIVARIATE ANALYSIS (Theory). Correlation and regression, principal components, canonical analysis, analysis of dispersion and covariance, tests of homogeneity, discriminant functions. Prerequisite, Stat 316.

315 (I). INTRODUCTION TO THE THEORY OF STATISTICS I (E).

Probability, random variables, probability distribution (with emphasis on the binomial and normal distributions), mathematical expectation, bivariate and multivariate distributions, sampling distributions, the central limit theorem, point estimation, maximum likelihood estimators, interval estimation. Prerequisite, Math 124/125/134 or 117/119 or 132/136/138 or 154.

316 (II). INTRODUCTION TO THE THEORY OF STATISTICS II (E).

Interval estimation, hypothesis testing, analysis of variance, regression, correlation, decision theory. Prerequisite, Stat 315.

Microbiology

Head of Department: Professor C. D. Cox. Professor Thorne; Associate Professors Canale-Parola, Dowell, Holt, Mortlock; Assistant Professors Czarnecki, Lessie, Norkin, Reiner, Wilder; Instructor Boggs.

Microbiology majors are required to have broad training in collateral sciences, and minimum requirements include chemistry through quantitative analysis and organic, one year each of introductory biological science and physics, and mathematics through calculus. Those students contemplating graduate study will be advised to emphasize stronger training in these collateral sciences, especially physical chemistry and biochemistry. Courses in microbiology are designed to offer fundamental training in the basic core areas and disciplines of this field. Microbiology 250, 280, 340, 391, and 392 are required of majors.

140 (I), (II). BIOLOGY OF MICROORGANISMS (E).

The microbial world, including history, structure, growth, ecology, physiology, pathogenesis, and microbial genetics. Lectures supplemented with visual aid material. Staff.

141 (I), (II). BIOLOGY OF MICROORGANISMS. Open only to nursing students concurrently registered for Microbiol 140. 1 3-hour laboratory period.

Credit, 1. Mr. Czarnecki.

250 (I), (II). GENERAL MICROBIOLOGY (E). Microbial structure, growth and physiology, and the reactions of microorganisms to their physical, chemical and biological environments. Designed for students intending to take more advanced courses in microbiology and for other science majors. Prerequisites, Chem 262 and 264, 166 and 168, or 160 and one semester of biological science. 2 class hours, 2 3-hour laboratory periods.

Credit, 4. Mr. Canale-Parola, Mr. Mortlock.

260 (I). MICROBIAL DIVERSITY (E).

Principles of selective enrichment and isolation; morphological, physiological and ecological characteristics of a number of microbial groups isolated from nature. Prerequisite, Microbiol 250. 2 class hours, 2 3-hour laboratory periods.

Credit, 4. Mr. Canale-Parola.

280 (II). PATHOGENIC BACTERIOLOGY.

Correlation of physiologic, metabolic, and immunologic properties of bacteria with pathogenesis of disease. Prerequisite, Microbiol 250. 2 class hours, 2 3-hour laboratory periods.

Credit, 4. Mr. Wilder.

310 (I). IMMUNOLOGY.

Fundamental study of nature of antigens and antibodies, their interactions and significance in resistance and hypersensitivity. Prerequisite, Microbiol 250. 2 class hours, 2 3-hour laboratory periods.

Credit, 4. Mr. Cox.

320 (II). VIROLOGY.

Structure, and chemical, physical and biological properties of viruses. Prerequisite, Microbiol 250, or permission of instructor. 2 class hours, 2 3-hour laboratory periods.

Credit, 4. Staff.

340 (II). MICROBIAL PHYSIOLOGY.

Fundamental studies of microbial chemistry and growth. Composition of bacterial cells, energy metabolism, biosynthesis of macromolecules and macromolecule precursor materials, and regulatory mechanisms governing these events. Prerequisite, Microbiol 250 or permission of instructor. Mr. Lessie, Mr. Mortlock.

385, 386. SENIOR RESEARCH.

Prerequisites, 8 credits of Microbiology and departmental permission. *Credit, 2-4. Staff.*

391, 392 (I), (II). SEMINAR.

Prerequisite, Microbiol 250. *Credit, 1. Staff.*

Music

Head of Department: Professor Philip Bezanson. Professors Alviani, Contino, King, Teraspulsky; Associate Professors du Bois (Associate Head), Gaver, Stern, Tillis; Assistant Professors Chesnut, Fussell, Harler, Humphrey, Jenkins, Kaeser, Lehrer, J. Olevsky, Ornest, Peltzer, Steele, P. Tanner, Weed, Whaples; Instructors Daehler, d'Armand; Lecturers Harry, E. Olevsky, J. Tanner.

The undergraduate degrees offered by the Department of Music are the Bachelor of Music and the Bachelor of Arts. A student must apply to the Department for admission. An audition is required of all applicants.

The Bachelor of Music degree may be earned in one of three areas of concentration: Music Education, Performance, or Theory-Composition. The three programs have a considerable amount of credits in common: University core requirements; Music History and Literature; Music Theory; Conducting; Applied Music and Ensemble.

In Music Education a student may elect to specialize in either the instrumental or vocal areas. Both areas include courses in music methods, education and student teaching in preparation for teaching certification. The curriculum for instrumental music education requires additional courses in applied brass, woodwind, string, percussion and instrumental conducting. The curriculum for vocal music education requires additional courses in language, vocal pedagogy, choral conducting and applied piano.

The curriculum for students majoring in performance includes credits in applied music, music literature and approved electives; a senior solo recital is required.

The Bachelor of Arts program for a music major serves the needs of the student who wishes to broaden his cultural background. It is pre-professional and may be suitable for specialized graduate studies. Concentration can be in one of three areas: Music History-Literature, Theory-Composition, or Performance. The junior-senior years will include a sequence of advanced courses suggested by the Department. A solo recital in the senior year is required of students majoring in Performance.

MUSIC

All music students register for large ensemble each semester and are expected to perform student recitals at regular intervals.

A minor in music may be elected by students in other departments. This program is as advised, and should include 111, 112, 201, 202 and four credits in ensemble or applied music. Education majors upon completion of 111, 112 may elect 241 in lieu of 201. University Bands, choral ensembles and orchestra are open to all University students by audition.

HISTORY AND APPRECIATION

101 (I), (II). INTRODUCTION TO MUSIC (C). Open to all students not majoring in music. Previous musical training not required. Basic music materials, principles of design, and cultural significance of representative works from the ninth century to the present.

102 (I). LITERATURE OF MUSIC (C). Review of music materials and principles of design. Emphasis on important examples of vocal music, keyboard music, chamber music, symphonies, concertos and operas from the Renaissance through the present time. Brief reference to Pre-Renaissance music. Listening and analysis. For music majors or by permission of instructor.

201 (I), 202 (II). HISTORICAL SURVEY OF MUSIC.

History and literature of music: Music 201, from early religious chant through Bach and Handel; Music 202, from 1750 through vocal and instrumental music of the twentieth century. Prerequisite, permission of instructor, or Music 112.

203 (I). MUSIC FROM MONTEVERDI TO BACH. Baroque and Rococo periods, including music of such composers as Monteverdi, Schutz, Lully, Purcell, Corelli, Couperin, Rameau, the Scarlattis, Bach, Handel. Prerequisite, Music 201 and permission of instructor.

205 (I). GOTHIC AND RENAISSANCE MUSIC. Chant and organum through Renaissance motet and madrigal. Reading, listening, score study, analysis. Prerequisite, Music 201 and permission of instructor.

209 (I), (II). MUSIC OF THE 20TH CENTURY. European and American music written since 1900, including Stravinsky, Bartok, Hindemith, Copland, jazz, electronic music. Prerequisite, Music 202 and permission of instructor.

301 (II). HAYDN, MOZART AND BEETHOVEN. Reading, listening, score study. Prerequisite, Music 202 and permission of instructor.

302 (II). MUSIC FROM SCHUBERT TO DEBUSSY.

History of nineteenth century romantic music in small and large forms, and various media including lieder, chamber music, symphony, opera. Reading, listening, score study. Prerequisite, Music 202.

303. HISTORY OF OPERA.

History of Opera from the late sixteenth to the present century. Prerequisite, permission of instructor.

THEORY

111 (I), 112 (II). ELEMENTARY MUSIC THEORY (C)

Open to Music majors only. Prerequisites, ability to read music, elementary skill at playing the piano, or permission of instructor. Music 111 including ear-training prerequisite to Music 112.

113 (I), 114 (II). INTERMEDIATE MUSIC THEORY.

Harmony and counterpoint including further studies in sight singing and ear-training. Further analysis of musical forms, including contrapuntal forms, and practice in writing original compositions. Prerequisite, Music 112 or equivalent; Music 113 including ear-training prerequisite to Music 114.

211 (I), 212 (II). ANALYSIS OF MUSIC LITERATURE.

Representative comparisons from the Baroque and Classic periods, second semester from the Romantic and Contemporary periods. Analysis by score and sound of various musical forms and media developed in each period. Prerequisite, Music 114. Non-music majors require permission of instructor.

215 (I). COUNTERPOINT.

The techniques of sixteenth century modal counterpoint. Analysis, listening, and written assignments. Prerequisite, Music 114.

216 (II). ORCHESTRATION.

Problems in scoring for various ensembles including full orchestra. Prerequisite, Music 114 or permission of instructor. 2 class hours. *Credit, 2.*

217 (I). CONTEMPORARY TECHNIQUES.

Examination of melody, rhythm, harmony, and form in twentieth century music. Analysis, listening, and written assignments. Prerequisite, Music 114. 2 class hours. *Credit, 2.*

311 (I), 312 (II). COMPOSITION.

Free composition in various forms and media. Individual lessons. Weekly Seminar. Prerequisite, permission of instructor, Music 114.

385, 386. SPECIAL PROBLEMS.

Individual study of a selected problem for qualified students. By arrangement with members of the department. *Credit, 1-3.*

MUSIC EDUCATION

118 (I), 119 (II). VOICE CLASS.

Vocal techniques. Open to instrumental music majors only. 1 class hour. *Credit, 1.*

221-229 (I), (II). INSTRUMENTAL TECHNIQUES.

Class lesson in Violin*. Materials and methods of teaching. Open to music majors only. 3 class hours, 2 laboratory hours. *Credit, 2.*

221-Violin*

222-Cello*

223-Flute*

224-Oboe* (Bassoon)*

225-Clarinet*

226-Horn*

227-Trumpet*

228-Trombone*

229-Percussion*

231 (I), (II). MUSIC FOR ELEMENTARY TEACHERS.

For the classroom teacher having little or no formal training in music. Principles of musical development with emphasis on classroom presentation. Rote and reading songs examined; processes of presentation evaluated.

241 (I). INSTRUMENTAL MUSIC IN THE ELEMENTARY AND JUNIOR HIGH SCHOOL.

Materials and methods of instrumental music teaching.

242 (I). CLASSROOM MUSIC IN THE ELEMENTARY AND JUNIOR HIGH SCHOOL.

Introduction to materials and methods. Open to Music Education majors and minors.

243 (II). CHORAL AND CLASSROOM MUSIC IN THE SENIOR HIGH SCHOOL.

Materials and methods of high school choral and classroom music.

244 (II). INSTRUMENTAL MUSIC IN THE SENIOR HIGH SCHOOL.

Materials and methods of instrumental music teaching.

245 (II). VOCAL PEDAGOGY.

Methods of teaching voice production. Prerequisite, 3 years of voice study. 1 class hour. *Credit, 1.*

247. MARCHING BAND TECHNIQUES.

Organization, training and repertoire for the high school and college marching band. Charting of drills, formations and continuity. 2 class hours. Prerequisite, two years of marching band experience.

363 (II). BASIC CONDUCTING.

Introduction to conducting. Prerequisite, Music 211. *Credit, 2.*

364 (I). INSTRUMENTAL CONDUCTING.

Rehearsal techniques and conducting of instrumental ensembles. Prerequisite, Conducting 363. 2 class hours. *Credit, 2.*

365 (I). CHORAL CONDUCTING.

Rehearsal techniques and conducting of vocal ensembles. Prerequisite, Conducting 363. 2 class hours. *Credit, 2.*

APPLIED MUSIC

Registration in Applied Music courses requires prior permission of the department. Music majors are not charged additional fees for applied lessons or practice rooms.

120 (I), (II). PIANO CLASS.

Piano proficiency. Required of all music majors. Not open to non-majors. By examination, or no more than four hours credit allowed. 1 class hour. *Credit, 1.*

121-138* (I), (II). INDIVIDUAL INSTRUCTION. Piano, voice, organ, strings, woodwinds, brasses, or percussion. Attention to development of performance skills

and study of appropriate literature. Student recitals provide an opportunity for frequent public performance. *Credit, 1-4. Staff.*

	<i>Woodwinds</i>
121 Piano	128 Flute
122 Organ	129 Oboe
123 Voice	130 Clarinet
	131 Bassoon
	132 Saxophone

<i>Strings</i>	<i>Brasses</i>
124 Violin	133 Trumpet
125 Viola	134 French Horn
126 Cello	135 Trombone
127 Bass	136 Baritone Horn
	137 Tuba
	138 Percussion

161* (I), (II). UNIVERSITY CHORALE.
A cappella choir selected by audition. Preparation and performance of choral literature ranging from the Renaissance to Contemporary. Concerts on campus and on tour. Three rehearsals a week. Chamber Singers selected from this group. May be repeated for credit.

Credit, 1. Mr. du Bois.

162* (I), (II). UNIVERSITY CHORUS.
Open to all students. Preparation and concert performance of oratorios and other large choral works. Two rehearsals a week. Madrigal Singers selected from this organization.

Credit, 1. Mr. Harler.

165* (I), (II). WOMEN'S CHOIR.
A select choir specializing in choral literature for women's voices. Audition required.

Credit, 1. Mr. Harler.

167 (I), (II). CHAMBER SINGERS.
Vocal ensembles specializing in performance of chamber music from Renaissance to Contemporary. Audition required.

Credit, 1.

168 (I), (II). MADRIGAL SINGERS.
Vocal ensemble specializing in music of the Renaissance. Audition required.

Credit, 1.

171* (I), (II). UNIVERSITY ORCHESTRA.
Preparation and performance of orchestral literature of various styles and periods.

Credit, 1. Mr. Steele.

181* (I). MARCHING BAND.
Preparation and performance of pre-game and half-time shows during football season. Prerequisite, attendance at pre-season band camp and permission of conductor. Freshmen and sophomores may elect Marching Band in lieu of required Physical Education during the marching season.

Credit, 1. Mr. Jenkins.

182* (I), (II). SYMPHONY BAND.
Preparation and performance of band and wind ensemble literature of various styles and periods.

Credit, 1. Mr. Jenkins.

183* (I), (II). CONCERT BAND.
Preparation and limited performance of selected band literature.

Credit, 1. Mr. Weed.

187* (I), (II). ENSEMBLE.
Preparation and performance of appropriate literature for small instrumental and vocal ensembles.

Credit, 1. Staff.

*May be repeated for credit. A maximum of four credits earned in applied music courses may be counted as credit toward graduation by students who are not music majors.

Philosophy

Head of Department: Professor Vere Chappell.
Professors Ackermann, Aune, Matthews, Sleigh, Wolff; Associate Professors Ehrlich, Gettier, Heidelberger, Parsons, Robison; Assistant Professors A. Brentlinger, J. Brentlinger, Clay, Feldman, Foster, Jubien.

105 (I), (II). INTRODUCTION TO PHILOSOPHY (C).

Some of the most important general questions, ideas, theories, and methods of inquiry which have given direction to Western thought.

110 (I), (II). ETHICS (C).

Classical and contemporary theories concerning policy formation and the justification of personal decisions and ways of life.

125 (I), (II). INTRODUCTION TO LOGIC (E).
The nature of critical thinking, including the functions of language, the structure of deductive arguments, and a glimpse at inductive methods.

161 (I). HISTORY OF PHILOSOPHY—
ANCIENT AND MEDIEVAL (C).

Development of Western thought from its earliest beginnings to the flowering of medieval scholasticism. Emphasis on the contribution of important movements and great thinkers.

162 (II). HISTORY OF PHILOSOPHY—
MODERN (C).

Continuation of Philos 161 from the Renaissance and the rise of modern science to nineteenth century idealism, positivism, and voluntarism.

201. PLATO AND ARISTOTLE (C).

The major works of Plato and Aristotle in ethics, logic, and metaphysics; the systematic character of their thought and its contemporary relevance. Prerequisite, one semester course in philosophy.

202. PHILOSOPHY IN THE MIDDLE AGES (C).

The writings of major philosophers of the period, including Augustine, Aquinas, Duns Scotus, and Ockham; their historical setting and relevance to modern thought. Prerequisite, one semester course in philosophy.

203. EUROPEAN PHILOSOPHY FROM
MONTAIGNE TO ROUSSEAU (C).

Representative philosophical texts of the period with concentration on authors of major historical influence such as Descartes, Spinoza, Leibniz, and Pascal. Prerequisite, one semester course in philosophy.

204. BRITISH EMPIRICISM (C).

Representative philosophical texts. Emphasis on Locke,

Berkeley, Hume and their historical influence, especially on contemporary empiricism. Prerequisite, one semester course in philosophy.

205. KANT AND 19TH CENTURY PHILOSOPHY (C).

Readings of original texts, with emphasis on Kant and selected nineteenth century thinkers. Prerequisite, one semester course in philosophy.

218. AMERICAN PHILOSOPHY (C).

Examination, by means of a study of selected original texts by the outstanding American philosophers, of their contribution to western thought and American civilization.

225 (I). INDIAN PHILOSOPHIES (C).

Theories of reality, of knowledge, of art, and of human destiny in the leading schools of Indian Asia; traditional and contemporary political theory.

226 (II). EAST ASIAN PHILOSOPHIES (C).

Theories of human nature, society, and the state in philosophies of Chinese and Japanese origin; the modification of Buddhism under the influence of Chinese thought.

230. PHILOSOPHY OF SCIENCE (E).

An introduction to the results of philosophical analysis of scientific practice, and the bearing of these results on a general description of scientific methodology.

241. RELIGIOUS PHILOSOPHIES (C).

Readings in contrasting religious philosophies, followed by analysis of concepts involved in understanding religion as related to other aspects of experience.

243. PHILOSOPHY OF ART (C).

The nature and function of artistic creation and expression, the analysis of aesthetic experience, the distinctive function of art in culture and personality, and the principles of criticism.

261 (I). CONTEMPORARY ANALYTIC PHILOSOPHY (C).

Russell, Carnap, Wisdom, the later Wittgenstein, Austin, Strawson, Quine. Prerequisite, one semester course in philosophy.

264 (I). EXISTENTIAL PHILOSOPHIES (C).

Examination by a study of selected original texts of the main problems peculiar to this movement as a whole and to its main exponents individually. Prerequisite, one semester course in philosophy other than 125.

290. POLITICAL PHILOSOPHY.

A systematic approach to major controversies in philosophy of political science and political ethics; *e.g.*, rationalism *vs.* empiricism, natural law *vs.* legal positivism. Prerequisite, one semester course in philosophy or permission of instructor.

291. MARXISM.

The moral, social, and political philosophy of Marx and Engels. Prerequisite, one semester course in philosophy or permission of instructor.

330. INTERMEDIATE PHILOSOPHY OF SCIENCE.

A critical analysis of the structure of scientific method and the language of science, the respective roles of

induction and deduction in science, and the status of theoretical terms. Prerequisites, three semester courses in philosophy, including 125.

341. PHILOSOPHY OF RELIGION.

Analytic study of the meaning and justifiability of beliefs concerning the existence and nature of God. Prerequisites, three semester courses in philosophy, including 125.

343. AESTHETICS.

Analytic study of selected problems in aesthetic theory. Prerequisites, three semester courses in philosophy, including 125.

344. EPISTEMOLOGY.

Examination of various accounts of the nature of knowledge; attention to basic principles of epistemic logic, probability, and certainty. Prerequisites, three semester courses in philosophy, including 125.

345. METAPHYSICS.

The basic problems of metaphysics. Problems include the nature of necessity, the relation between universals and particulars, the concept of causality, and the relative merits of competing metaphysical views, such as materialism, idealism, and dualism. Prerequisite, three semester courses in philosophy, including 125.

350. HISTORY OF ETHICS.

Theories of important figures in the history of ethics, presented chronologically. Works in the following traditions will be represented: ancient Greek ethics; natural law and natural right theorists; the British moral sense, sympathy, and sentiment theorists; Kant; utilitarianism; self realization; pragmatism; and contemporary intuitionists. Prerequisites, two semester courses in philosophy above 200.

351. ETHICAL THEORY.

Some major problems of ethical theory. Emphasis on definition, the status of ethical statements, and reasoning and justification in ethics. Prerequisites, two semester courses in philosophy, including 125.

365. PHILOSOPHICAL THEOLOGY.

Systematic and historical inquiry into the methods, problems, and directions of theological thought. Prerequisites, two semester courses in philosophy above 200.

370. INTERMEDIATE LOGIC.

First order quantification theory with relations, identity, and definite descriptions; an introduction to one or more of the following: modal logic, epistemic logic, deontic logic, tense logic, and many-valued logics. Prerequisite, Philos 125.

371. PHILOSOPHY AND LOGIC.

Informal exposition of results of modern logic that are of philosophical significance. Topics chosen from: semantics for first-order theories; Lowenheim-Skolem theorem; Herbrand-Gentzen theorem; Gödel's incompleteness theorem for first-order elementary number theory; Church's undecidability theorem for quantification theory; Tarski's semantic conception of truth; paradoxes of abstract set theory. Prerequisite, Philos 370.

372. MATHEMATICAL LOGIC I (E).

Axiomatization of sentential logic and the lower functional calculus; the syntax and semantics of first-order theories including results concerning consistency, adequacy, completeness, and elementary model theory. Prerequisite, Philos 370 or major in mathematics.

373. MATHEMATICAL LOGIC II (E).

Formalization of elementary number theory as a first-order theory; Gödel's theorem concerning incompleteness of number theory; introduction to the theory of recursive functions. Prerequisite, Philos 372 or major in mathematics.

381. SELECTED ANCIENT OR MEDIEVAL PHILOSOPHER.

Intensive study in the works of a single ancient or medieval philosopher, such as Plato, Aristotle, or Aquinas. Prerequisites, Philos 125, 161 or 201, and one additional semester course in philosophy.

382. SELECTED MODERN CONTINENTAL PHILOSOPHER.

Intensive study in the works of a single modern continental philosopher, such as Descartes, Spinoza, Leibniz, Kant, or Hegel. Prerequisites, Philos 125, 162 or 203, and one additional semester course in philosophy.

383. SELECTED MODERN BRITISH PHILOSOPHER.

Intensive study in the works of a single modern British philosopher, such as Locke, Berkeley, Hume, or Mill. Prerequisites, Philos 125, 162 or 204, and one additional semester course in philosophy.

(381, 382, and 383 may be repeated for an additional 3 credits provided the topic is different on each occasion.)

384. CONTEMPORARY PROBLEMS.

Selected persistent philosophical problems—e.g., induction, relation of mind and body, perception, certainty of statements, knowledge of other minds. Prerequisites, Philos 125 and two additional semester courses in philosophy.

385, 386. SPECIAL PROBLEMS.

Individual study of a selected problem for qualified students. By arrangement with members of the department. *Credit, 1-3.*

390, 391. SEMINAR.

One major philosopher, major philosophical tradition, or restricted subject in a special field of philosophical inquiry. Prerequisites, two semester courses in philosophy numbered above 200, or permission of department.

Physics and Astronomy

Head of Department: Professor L. F. Cook. Professors Brehm, Engelsberg, Gluckstern, Harrison, Inglis, Irvine, Jones, Quinton, Rosen, Ross, Shafer, Soltysik, Sternheim, Strong; Associate Professors Army, Byron, Ford, Freytag, Goldenberg, Golowich, Guyer, Hertzbach, Huguenin, Koffler, Krotkov, Mullin, Penchina, Peterson, Pichanick, Sastry, Schultz, Swift; Assistant Professors Chang, Crooker, Dent, Gerace, Hallock, Hoffman, Hol-

stein, Kane, Langley, Manchester, Mathieson, McMahan, Tademaru, Taylor, Van Blerkom, Walker, Whitney; Staff Associate Gray; Research Associates and Lecturers Carson, Gabler, Jacobs, Johnson, Kanal, Lasley, Li.

PHYSICS

Many introductory courses are offered by the Department of Physics and Astronomy: Physics 115, 116, 117, 118 describe special topics in physics and are primarily of cultural value; Physics 121-122 is a broader survey of physics designed for non-science majors; Physics 141-142 is a broad survey of physics which caters to the needs of science majors in general, including those who plan to go to medical school. None of the above courses is normally available for major credit in Physics. Physics 100, providing the highlights in Physics in one semester, offers an excellent opportunity for a student to test his interest in Physics as a possible major area.

Physics 161-162-163 provide the necessary background in physics for Engineering, Chemistry and other Physical Science majors.

Students planning to major in Physics may consider one of two kinds of programs: the R-program, aimed at those who wish to pursue research and university careers and plan to go on to graduate study in physics, and the T-program, designed for those who plan to go into inter-disciplinary work, physics teaching at the high school level or science-oriented administrative technical and business careers. Considerable flexibility is available in this latter program to suit the needs and goals on an individual basis. Although it is possible to switch between the two programs until fairly late stages, students are strongly urged to plan their courses early in consultation with faculty advisers in the Department. Either the series Physics 181-182-183-184 or Physics 161-162-163 is appropriate for majors in the Freshman and Sophomore years, Although Physics 181-184 is the preferred start for students interested in the R-program. This series is also available for non-physics majors who may wish to learn physics at a relatively sophisticated level. The mathematics requirement is satisfied by the sequence Mathematics 131-132-165, although Mathematics 135-136-165 is preferred.

In addition to the above, the following are minimum requirements for a B.S. or B.A. in Physics: 18 credits in upper division courses in the Department of Physics and Astronomy (must include at least 4 credits in electricity and magnetism with a laboratory), 3 credits in modern physics and 3 credits in advanced experimental work (or an experimental honors project). Normal preparation for graduate study in Physics (R-program) consists of several Physics and Mathematics courses in addition to the minimum requirements (see the

following typical program). The distinction between the B.S. and B.A. degrees is made on the basis of distribution requirements set by the College of Arts and Sciences.

Typical Program for R-Program Physics Major:

Freshman Year:	Physics 181 Math 135 Science elective	Physics 182 Math 136 Science elective
Sophomore Year:	Physics 183 Math 165	Physics 184 Math 341
Junior Year:	Physics 251 Physics 255 Physics 387 or	Physics 252 Physics 256 Physics 319
Senior Year:	Physics 271 Physics 285 Physics 385	Physics 272 Physics 286 Physics 386

Typical Program for a T-Program Major:

Freshman Year:	Physics 100 Math 130 Science elective	Physics 161 Math 131 Science elective
Sophomore Year:	Physics 162 Math 132	Physics 163 Math 165
Junior Year:	Physics 200	Physics 301 Physics 385 Physics 390
Senior Year:	Physics 302 Physics 386 Physics 390	Education Block or other electives

100 (I). INTRODUCTION TO PHYSICS:

THE WORLD BEYOND OUR SENSES (E).
The universe in terms of its basic building blocks — atoms, nuclei, and “elementary particles.” New views of nature derived from our ability to see and measure the world of the very small.

115 (II). PHYSICS OF MUSIC (E).

Elementary concepts of physics of sound in the production and reception of music. No previous physics training required; largely non-mathematical presentation. Emphasis on basic principles. Some historical perspective developed. Individual instruments discussed with demonstrations.

116 (I). RELATIVITY(E).

As much general physics material as is required for an understanding of the fundamental principles of relativity, and of their consequences in other fields. Intended for the general student. No background in physics or science required. Prerequisites, high school algebra and trigonometry.

117 (II). NUCLEAR ENERGY, ITS PHYSICS
AND ITS SOCIAL CHALLENGE (E).

Basic physical concepts clarifying the nature of atoms and nuclei; the workings, capabilities and possible perils of nuclear reactors and explosives; associated social, political and diplomatic problems and challenges. Prerequisite, high school algebra. Students with more background in separate section.

118 (I). ELEMENTS OF QUANTUM PHYSICS (E).

Atoms and their structure, matter waves, duality, Pauli principle, spin, uncertainty principle, role of models in physics, application of concepts of quantum physics to solid state, nuclear and elementary particle physics, philosophical implications. Necessary background of classical physics. Prerequisites, high school algebra and trigonometry.

121 (I), 122 (II). CONCEPTS OF PHYSICS (E).
Mechanics, sound, heat, electricity, light, atomic and nuclear concepts. Conventional topics may be replaced to suit specific undergraduate majors, to emphasize historical, biographical and conceptual rather than mathematical approaches. Physics 121 prerequisite for Physics 122. 2 class hours, 1 2-hour laboratory period.

Credit, 3 each semester.

130 (I), (II). PHYSICS FOR ELEMENTARY
EDUCATION MAJORS.

Physical phenomena and the schemes for their representation. Topics from mechanics, electricity and magnetism, waves, optics and properties of matter. Mathematics at the level of algebra, trigonometry and simple geometry developed as required. For elementary education majors only. 2 class hours, 1 2-hour laboratory.

141 (I), 142 (II). INTRODUCTORY PHYSICS I, II (E).

Mechanics, sound, heat; electricity, magnetism, light and modern physics, using trigonometry and algebra, but not calculus. Intended for pre-medical, pre-dental, pre-veterinary, and some science major students. Prerequisites, Math 121 previously or concurrently for Physics 141; Physics 141 for Physics 142. 3 class hours, 1 2-hour laboratory period.

Credit, 4 each semester.

161 (I), (II). GENERAL PHYSICS I (E).

Mechanics. For students primarily interested in engineering, chemistry, or mathematics. Prerequisite, Math 135 or equivalent previously, or concurrently with special permission. 2 lectures, 2 recitations; 1 2-hour laboratory in alternate weeks.

Credit, 4.

162 (I), (II). GENERAL PHYSICS II (E).

Heat, electricity, and magnetism. Prerequisites, Math 135 or equivalent, Physics 161; Math 136 previously or concurrently. 2 lectures, 2 recitations; 1 2-hour laboratory in alternate weeks.

Credit, 4.

163 (I), (II). GENERAL PHYSICS III (E).

Electromagnetic radiation, optics, atomic and nuclear physics. Prerequisites, Math 136; Physics 162. 2 lectures, 1 recitation; 1 2-hour laboratory period.

Credit, 4.

171 (II). HONORS GENERAL PHYSICS I (E).

For students of science, engineering and mathematics with good mathematical preparation. 3 class hours of informal lecture and discussion, 1 2-hour laboratory in alternate weeks. Permission of adviser or instructor. Topics and prerequisites, see 161 (II).

Credit, 4.

172 (I). HONORS GENERAL PHYSICS II (E).

For students of science, engineering and mathematics with good mathematical preparation. 3 class hours, 1 2-hour laboratory in alternate weeks. Permission of adviser or instructor. Topics and prerequisites, see 162 (I).

Credit, 4.

181 (I), 182 (II). INTRODUCTORY PHYSICS I, II FOR PHYSICS MAJORS (E).

Limited-enrollment course for Physics majors or others interested in an introductory course at an advanced level. Subjects include: vector analysis, laws of mechanics, application to rigid body motion, conservation laws, complex numbers, wave motion, thermodynamics, kinetic theory. Corequisite, Math 123, 124 or equivalent. Permission of department required. 3 class hours, 1 2-hour laboratory period. *Credit, 4 each semester.*

183 (I), 184 (II). INTRODUCTORY PHYSICS III, IV FOR PHYSICS MAJORS (E).

Continuation of 181, 182. Subjects covered include: laws of electricity and magnetism, radiation, light, geometrical and physical optics, relativity, modern physics. Prerequisites, Physics 181, 182; corequisite, Math 173, 174 or equivalent. 3 class hours, 1 2-hour laboratory period. *Credit, 4 each semester.*

200 (I). ELECTRICITY AND ELECTRONICS.

Basic ideas of electricity and magnetism. Emphasis on conceptual development. Topics include D.C. and A.C. circuits, electromagnetic field theory and Maxwell's equations, electron ballistics, vacuum tubes and transistors. Laboratory deals with electrical measurements and electronic devices such as power supplies, amplifiers, etc. Prerequisites, Physics 162 or 183 or equivalent, and Math 174. 3 class hours, 1 2-hour laboratory period. *Credit, 4.*

251 (I). ELECTRICITY AND MAGNETISM I.

Classical field theory, static electric fields and magnetic fields of steady currents. Scalar and vector potentials. Laplace's equation and its solutions. Prerequisites, Physics 142, 162, or 183; Math 174 or 186.

252 (II). ELECTRICITY AND MAGNETISM II.

Continuation of 251. Time-varying-fields. Maxwell's equations and applications to radiation. Prerequisites, Physics 251 and Math 187 or 343.

254 (II). METEOROLOGY.

Theoretical treatment of various atmospheric phenomena, with correlation of observation and theory. Weather observations, preparation of weather charts, and weather forecasting. Prerequisites, Physics 142, or 162 or 184; Math 174 or 186.

255 (I), 256 (II). MECHANICS I, II.

Development of the fundamental concepts of dynamics with applications to particles and rigid bodies in translation and rotation. At the level of Becker's Theoretical Mechanics. Prerequisites, Physics 142, or 162 or 184; Math 174 or 186.

264 (II). WAVE MOTION.

Physical optics, acoustics and other wave phenomena discussed in a unified way. Prerequisite, Physics 252.

271 (I), 272 (II). STATISTICAL PHYSICS I, II.

Presentation of thermodynamics, kinetic theory and statistical mechanics in a unified structure. Prerequisites, Physics 142 or 162 or 184, and Math 174 or 186.

285. MODERN PHYSICS I.

Review of classical mechanics, theory of relativity, black body radiation, photoelectric effect, Compton effect, background for development of quantum mechanics, Bohr atom. Prerequisites, Physics 252, 256.

286 (II). MODERN PHYSICS II AND QUANTUM MECHANICS.

Quantum mechanics, application to atomic and nuclear physics, such as atomic spectra, Zeeman effect, angular momentum, barrier penetration. Prerequisite, Physics 285. 4 class hours. *Credit, 4.*

288 (I). SOLID STATE PHYSICS.

Introduction to theoretical and experimental physics of the solid state. Prerequisite, permission of instructor.

301 (II). CONCEPTS OF MODERN PHYSICS I.

Fundamental concepts of twentieth century physics. Topics include kinetic theory, transport phenomena, shell structure of atoms, basic principles of quantum mechanics. Prerequisite, Physics 163 or 184 or equivalent, Math 174.

302 (I). CONCEPTS OF MODERN PHYSICS II.

Continuation of Physics 301. Topics include relativity, properties and structure of nuclei, nuclear reactions, new quantum numbers and families of elementary particles; aspects of space physics such as Van Allen radiation belts; properties of matter in the solid state. Prerequisite, Physics 301 or equivalent, permission of instructor.

319 (II). ELECTRONICS INSTRUMENTATION.

A laboratory-oriented course designed expressly for physicists and chemists. Basic electronics principles, servo systems, operational amplifiers, digital circuits, other modern devices. Prerequisite, permission of instructor. 1 class hour, 1 4-hour laboratory period.

385, 386. SPECIAL PROBLEMS.

Individual study of a selected problem for qualified students. By arrangement with members of the department. *Credit, 1-3.*

387 (I), (II). SPECIAL TOPICS IN ELECTRICAL MEASUREMENTS.

Selected experiments performed by students to gain experience in methods of electrical measurements. Normally open to junior majors. 1 to 3 2-hour laboratory meetings a week. *Credit, 1 to 3 each semester.*

390. SEMINAR.

An aspect of physics not usually covered in regular course offerings. Normally open to upper division Physics majors. Prerequisite, permission of instructor. *Credit, 1-3.*

ASTRONOMY (A Five-College Department)

Chairman: Professor William M. Irvine. Professors Harrison, Seitter, Strong; Associate Professors Army, Huguenin; Assistant Professors Dennis, Dent, C. Gordon, K. Gordon, Greenstein, Tadamaru, Taylor, Van Blerkom.

100 (I), (II). EXPLORING THE UNIVERSE (E).

Not open to Physical Science or Engineering majors. The earth, its structure and age, the moon, the sun, other planets and the origin of the solar system. Stars and galaxies, their birth and death. The universe, its structure and evolution. Supplemented by occasional hours of evening observation.

101 (I). ELEMENTARY ASTRONOMY (E).

The solar system, earth, moon tides, laws of motion, planets and satellites, the sun. Origin of the solar

system and current theories on the origin of life. Supplemented by occasional hours of evening observation. 3 class hours, 1 1-hour laboratory period.

102 (II). ELEMENTARY ASTRONOMY (E).

The astronomical universe. Astronomical instruments. Stellar distances and motions, star clusters and nebulae. Cosmology. Supplemented by occasional hours of evening observation. 3 class hours, 1 1-hour laboratory period.

122 (I), (II). INTRODUCTION TO ASTRONOMY AND ASTROPHYSICS (ASTFC 22) (C).

For astronomy majors or others interested in a quantitative introductory course. A description of our present knowledge of the universe and the means by which this knowledge has been obtained. The properties of the solar system, individual and multiple stars, interstellar matter, our galactic system, external galaxies, and the possibility of extraterrestrial life. Prerequisite, Physics 181 (or 161 or 141), Math 124 (or 136) or permission of instructor. *Credit, 4.*

231 (I). SPACE SCIENCE: TOPICS OF CURRENT ASTRONOMICAL RESEARCH (ASTFC 31) (C).

Intended primarily for students in major program I. A discussion of selected topics from current astronomical research. Choice of topics depends upon the instructor and may include the aims and results of space research and exploration, recent developments in stellar evolution, cosmology, and current research in radio astronomy. The discussion is in depth, but does not require advanced mathematics. Prerequisites, Astron 101-102 or 122 and Math 111 or 123.

234 (II). DEVELOPMENT OF ASTRONOMY (ASTFC 34).

The progress of astronomy, traced from prehistoric petroglyphs to the space age. Emphasis on the development of important ideas in the field and the relation of astronomy to other cultural trends. Supplemented by occasional use of the planetarium and the departmental telescopes. Prerequisites, Astron 101-102 or 122.

237 (I). ASTRONOMICAL OBSERVATION (ASTFC 37) (C).

Intended primarily for students in major Program I. An introduction to the techniques of gathering and analyzing astronomical data. Subjects to be covered depend somewhat on individual interests: fundamental astronomical catalogues and their uses, photography, photometry, spectroscopy and classification of spectra, techniques of planetarium use, basic radio astronomy, introduction to telescope design and use, the astronomical distance scale. Three hours of classroom work per week, some of which will be observing sessions to be arranged. Prerequisite, Astron 101-102, or 122, or permission of instructor.

238 (II). TECHNIQUES OF MODERN ASTRONOMY (ASTFC 38).

An introduction to modern methods of astronomical observation and data reduction. Specific techniques of optical astronomy, radio astronomy, and space astronomy are discussed and analyzed. Laboratory experiments and field observations performed by students during the semester. Prerequisite, Physics 184 or permission of instructor.

343 (I). ASTROPHYSICS I (ASTFC 43).

Basic topics in astrophysics. Equilibrium configurations and the physical state of stellar interiors. Polytrope models. Interaction of radiation and matter, and radiative transfer. Radiative and convective equilibrium. Study of opacity. Prerequisite, concurrent enrollment in Physics 251 or permission of the department. 4 class hours. *Credit, 4.*

344 (II). ASTROPHYSICS II (ASTFC 44).

Interaction of matter and radiation. Radiative transfer. Introduction to the physics of stellar and planetary atmospheres. Interplanetary and interstellar particles. Extraterrestrial radio emission. Prerequisite, Astron 343, or permission of the department. 4 class hours. *Credit, 4.*

385 (I or II), 386 (I or II). SPECIAL PROBLEMS.

An individual research project approved by the department. Prerequisite, permission of the department.

Political Science

Chairman of Department: Glen Gordon. Professors Beth, Brauthal, Fenton, Fliess, Harris, Houn, Howards, Lederle, Lewy, Mainzer, Maki, Oppenheim, Speier, Syed, Vali; Associate Professors Alfange, Allen, Booth, Connolly, Coulter, Feit, Gere, Goldman, King, Meo, Shanley, Wiarda; Assistant Professors Eagan, Friedman, Kline, Kramer, Mileur, Ryavec, Steeper, Sulzner; Instructors Bach, Einhorn; Lecturer Reid.

100 (I), (II). AMERICAN POLITICS (D).

Introduction to constitutional principles and public policy making in American national government. Democratic theory, major national political institutions, electoral behavior, and selected public policy questions. *Staff.*

150 (I), (II). COMPARATIVE POLITICS (D).

Introduction to political structures, processes and comparative national development in parliamentary, one-party, and other political systems. The relationship of cultural values to institutions; emphasis on such forces of change as democracy, industrialization, and revolution. *Staff.*

161 (I), (II). WORLD POLITICS (D).

Introduction to the nature, dynamics, and problems of world politics. Nationalism, ideology, and other forces underlying the foreign policies of the United States, the Soviet Union, and other states, as illustrated by selected contemporary issues. *Staff.*

201 (I), (II). ANCIENT AND MEDIEVAL POLITICAL THOUGHT (D).

Development of political thought and its relation to cultural and institutional growth from the time of the Greeks to the end of the Middle Ages.

Mr. Connolly, Mr. King, Mr. Lewy, Mr. Oppenheim.

202 (I), (II). MODERN POLITICAL THOUGHT (D).

Development of political thought and its relation to cultural and institutional growth from the rise of the modern state to the present.

Mr. Connolly, Mr. King, Mr. Lewy, Mr. Oppenheim, Mr. Syed.

- 203 (I), (II). PROBLEMS IN POLITICAL THOUGHT (D).**
An analysis of central concepts and themes in political theory. Major orientations in both classical and contemporary thought.
Mr. Connolly, Mr. King, Mr. Mileur, Mr. Oppenheim.
- 218 (I), (II). POLITICAL PARTIES AND ELECTIONS (D).**
American political processes. Emphasis on parties, pressure groups, and public opinion.
Mr. Coulter, Mr. Fenton, Mr. Gordon, Mr. Mileur, Mr. Shanley, Mr. Sulzner.
- 219 (I), (II). STATE GOVERNMENT (D).**
American state politics, organization, and functions. The role of the state in our federal system. Prerequisite, Pol Sci 100 or permission of instructor.
Mr. Booth, Mr. Coulter, Mr. Gere, Mr. Howards, Mr. Shanley.
- 220 (I), (II). MUNICIPAL GOVERNMENT (D).**
Survey of the structure and function of government in American municipalities.
Mr. Booth, Mr. Coulter, Mr. Gere, Mr. Grady, Mr. Howards, Mr. Shanley.
- 221 (II). THE PRACTICE OF AMERICAN POLITICS.**
Practical American politics, taught by a prominent political leader under the University Distinguished Professorship in Public Affairs. Prerequisite, Pol Sci 100. 2 class hours.
Credit, 2.
- 222 (I). MASSACHUSETTS POLITICS (D).**
Analysis of the significant characteristics of Massachusetts politics as applied to political problems from an historical perspective with both a theoretical and practical base. Field work supplements readings, lectures, and discussions.
Mr. Friedman.
- 233 (I), (II). GOVERNMENT AND POLITICS OF THE MIDDLE EAST (D).**
Review of the dynamics of the traditional Islamic political system and of the transformation of that system under the impact of Western penetration of the Middle East. Contemporary Middle East politics with special reference to Israel, Syria, Lebanon, and the UAR.
Miss Meo.
- 234 (II). GOVERNMENT AND POLITICS OF JAPAN (D).**
Government and politics of modern Japan; emphasis on post-1945 period. Descriptive analysis of structure and function of governmental and political processes.
Mr. Maki.
- 235 (I), (II). GOVERNMENTS OF EAST CENTRAL EUROPE (D).**
Survey of the major governments in the East Central European area; emphasis on the nature of Communist Party control. Governments include those of Czechoslovakia, East Germany, Hungary, Poland, Rumania, Yugoslavia, and others. Prerequisite, Pol Sci 150 or permission of instructor.
Mr. Ryavec, Mr. Vali.
- 236 (I), (II). GOVERNMENT AND POLITICS OF THE SOVIET UNION (D).**
Historical and ideological influences on Soviet politics; the interconnection of social and political institutions and processes; membership, organization, and operation of the Communist Party; the state structure and law; and contemporary Soviet foreign policy. Prerequisite, Pol Sci 150 or 161, or History 100-101, or permission of instructor.
Mr. Fliess, Mr. Ryavec, Mr. Vali.
- 237 (I), (II). GOVERNMENT AND POLITICS OF CHINA (D).**
Analysis of the political ideologies, party movements, governmental institutions, and major domestic and foreign policies of contemporary China. Prerequisite, Pol Sci 150 or 161 or permission of instructor.
Mr. Houn.
- 238 (I), (II). GOVERNMENT AND POLITICS OF SOUTH AND SOUTHEAST ASIA (D).**
Comparative study of the institutions and dynamics of government and politics in South and Southeast Asia, especially in India, Pakistan, Indonesia, and Malaysia. The issues of political stability, economic development, and relations with the United States and other great powers. Prerequisite, Pol Sci 150 or 161 or permission of instructor.
Mr. Allen, Mr. Syed.
- 239 (I), (II). WEST EUROPEAN COMPARATIVE POLITICS (D).**
Analysis of the political cultures, institutions, systems and processes of selected West European countries. Emphasis on social and economic factors relating to contemporary political issues.
Mr. Braunthal, Mr. Einhorn, Mr. King.
- 240 (I). GOVERNMENT AND POLITICS OF SOUTH AMERICA (D).**
Comparative analysis of the interest groups, political parties, and governmental institutions of the South American countries. Emphasis on the background and political culture in which Latin American politics and government take place. Prerequisite, Pol Sci 150 or previous courses in Latin America, or permission of instructor.
Mr. Kline, Mr. Wiarda.
- 241 (II). GOVERNMENT AND POLITICS OF CENTRAL AMERICA AND THE CARIBBEAN (D).**
Comparative analysis of the interest groups, political parties, and governmental institutions of the Central American and Caribbean countries. Emphasis on communism and the role of the U.S. Prerequisite, Pol Sci 150, or previous courses in Latin America, or permission of instructor.
Mr. Kline, Mr. Wiarda.
- 242 (I). THE POLITICS OF SUB-SAHARAN AFRICA (D).**
Organization and processes of African politics, centering on the general political problems facing contemporary African governments. Prerequisite, permission of instructor.
Mr. Feit, Mr. Steeper.
- 243 (I), (II). COMPARATIVE AFRICAN GOVERNMENTS (D).**
Comparative study of the political processes of five African states. Prerequisite, Pol Sci 242 or permission of instructor.
Mr. Feit, Mr. Steeper.
- 244 (II). POLITICAL DEVELOPMENT AND MODERNIZATION (D).**
Comparative analysis of political change and development in the emerging nations.
Mr. Maki, Mr. Wiarda.
- 248 (I), (II). GREAT BRITAIN AND THE COMMONWEALTH (D).**
The practice of parliamentary government in Great

Britain and the Commonwealth countries. Emphasis on the development of the conception of the Commonwealth, the institutions through which it operates, and its role in contemporary world politics. Prerequisite, Pol Sci 150 or 161 or permission of instructor.

Mr. Harris.

254 (I), (II). **INTERNATIONAL RELATIONS (D)**. The nation-state system and conceptions of national interest in modern world politics. Emphasis on forms and distribution of power, making of foreign policy, and adjusting of international conflict. Prerequisite, Pol Sci 150 or 161, or History 101, or permission of instructor.

Mr. Allen, Mr. Braunthal,

Mr. Fliess, Mr. Steeper, Mr. Vali.

272 (I), (II). **PUBLIC ADMINISTRATION (D)**. Organization of bureaucracy, bureaucratic life, constitutional position and political role of governmental bureaucracy. Prerequisite, Pol Sci 100 or permission of instructor.

Mr. Kramer, Mr. Lederle, Mr. Mainzer, Mr. Reid.

273 (II). **PUBLIC PERSONNEL ADMINISTRATION.**

The personnel function in bureaucracy; patronage and merit; career service and political executive; authority and informal organization; employee rights and collective action. Prerequisite, Pol Sci 100 or permission of instructor.

Mr. Kramer, Mr. Lederle, Mr. Mainzer.

275 (I). **COMPARATIVE PUBLIC POLICY (D)**. Comparative analysis of policy formation. Emphasis on the process of social and economic policy decision-making in selected industrial societies; the interaction of institutions, ideas, and power in decisions concerning social welfare, economic planning, and related policy areas. Prerequisite, Pol Sci 150 or Econ 125.

Mr. Einhorn.

276 (II). **POLITICAL THEORY AND PUBLIC POLICY (D)**.

Evaluation of social policy in the United States. Emphasis on normative issues raised in controversies over selected cases of social and economic policy in the light of the main traditions of Western political thought and of recent work on the logical and ethical aspects of social choice. Prerequisite, Pol Sci 100 or permission of instructor.

Mr. Eagan.

277 (I). **ARMED FORCES AND POLITICAL POLICY (D)**.

Comparative study of civilian-military relations in Western and non-Western nations. Emphasis on both regular and irregular armed forces.

Mr. Feit.

290 (I), (II). **CONSTITUTIONAL LAW (D)**.

Historical study of the United States Constitution as interpreted by decisions of the Supreme Court. Prerequisite, Pol Sci 100 or permission of instructor.

Mr. Alfange, Mr. Beth, Mr. Goldman.

291 (I), (II). **THE LAW AND PRACTICE OF CIVIL LIBERTIES (D)**.

Development in American Constitutional Law of the concept of civil liberty, including free speech and religion, fair trial, and race discrimination. Prerequisite, Pol Sci 100 or permission of instructor.

Mr. Alfange, Mr. Beth, Mr. Goldman.

292 (I), (II). **POLITICS, THE LAW AND JUDICIAL BEHAVIOR (D)**.

Law as the political and social means of adjusting needs and desires to governmental policy. Emphasis on

judicial behavior in lawmaking and law enforcing. Prerequisite, Pol Sci 100 or permission of instructor.

Mr. Alfange, Mr. Beth, Mr. Goldman.

303 (I), (II). **AMERICAN POLITICAL THOUGHT (D)**.

Development of American political thought from colonial times to the present.

Mr. Gere, Mr. Mileur, Mr. Syed.

306 (II). **COMMUNIST POLITICAL THOUGHT**. Philosophical and religious origins of communism in Western and Eastern Europe; analysis of the classics from Marx to Khrushchev. Emphasis on causes, nature, and effect of communism as the ideology of a national and international movement; communist theory of state, law, and democracy; and socialist ethics.

Mr. Fliess.

321 (I), (II). **THE PRESIDENCY IN AMERICAN GOVERNMENT (D)**.

Constitutional and political aspects of the presidency in legislation, administration and conduct of foreign and military affairs. The President as party leader. Prerequisite, Pol Sci 100 or permission of instructor.

Mr. Bach, Mr. Gordon, Mr. Kramer,

Mr. Reid, Mr. Sulzner.

322 (II). **THE LEGISLATIVE PROCESS (D)**. Analysis of American legislative systems and processes. Emphasis on the United Nations and regional organization executive in legislative decision-making. Prerequisite, Pol Sci 218 or permission of instructor.

Mr. Bach, Mr. Gordon, Mr. Sulzner.

323 (II). **PUBLIC OPINION IN POLITICS (D)**. Analysis of opinion and communication as aspects of the political process. Emphasis on communication through the mass media.

Mr. Fenton.

324 (I), (II). **METROPOLITAN POLITICS (D)**. Problems of metropolitan areas; actual and possible political approaches to their solution. Emphasis on the role of parties, the development of political leadership, existing political institutions, and pressure group activity. Prerequisite, Pol Sci 218 or permission of instructor.

Mr. Booth, Mr. Coulter, Mr. Howards, Mr. Shanley.

325 (II). **BLACK POLITICS (D)**.

Theoretical and historical analysis of the relationship of Black people to the American political system. Emphasis on the development of Black ideologies, political organizations, and strategies and on alternative forms of participation in the American political system.

Mr. Booth, Mr. Sulzner.

355 (II). **AMERICAN FOREIGN POLICY (D)**. Principles of American foreign policy. Emphasis on constitutional, political, and administrative considerations that influence the formation and execution of foreign policy. Prerequisite, introductory sequence in Political Science or permission of instructor.

Mr. Allen, Mr. Braunthal, Mr. Steeper.

356 (II). **INTERNATIONAL LAW (D)**.

The origin, character, and function of international law. Prerequisite, Pol Sci 254 or History 211 or permission of instructor.

Mr. Allen, Mr. Braunthal, Mr. Fliess, Mr. Vali.

357 (II). **INTERNATIONAL ORGANIZATION (D)**.

International organization in the twentieth century. Emphasis on the United Nations and regional organizations. Prerequisite, Pol Sci 254 or History 211 or permission of instructor.

Mr. Allen, Mr. Braunthal, Mr. Fliess, Mr. Vali.

358 (I). INTERNATIONAL RELATIONS:

ASIA (D).

Introduction to general problems of Asian international relations since 1859, with detailed examination of problems since World War I. Emphasis on China, Japan, and the new nations. Mr. Houn, Mr. Maki.

359 (I). WESTERN EUROPE AND THE ATLANTIC COMMUNITY (D).

Analysis of the emerging institutional patterns of the West European and Atlantic communities. Emphasis on the major political, military, and economic regional organizations. Mr. Braunthal, Mr. Einhorn.

360 (II). SOVIET FOREIGN POLICY (D).

Analysis of continuity and change in Soviet perceptions, goals, methods, and priorities in foreign policy. Emphasis on the period since World War II.

Mr. Ryavec.

361 (II). CHINESE FOREIGN POLICY (D).

Examination of the geographical, historical, ideological, economic, military, and other factors in Peking's foreign policy since 1949. Emphasis on mainland China's relations with various countries and her positions on major international issues.

Mr. Houn.

374 (II). ADMINISTRATIVE LAW (D).

Governmental activities in the regulation of industry, agriculture, and labor. Emphasis on the legal framework within which these activities operate.

Mr. Lederle.

385, 386. SPECIAL PROBLEMS.

Individual study of a selected problem for qualified students. By arrangement with members of the department. Credit, 1-3.

391, 392. SEMINAR.

Special problems in the study of politics.

Staff.

393 (I). SENIOR HONORS SEMINAR.

Seminar for senior honors students on the study of politics. Prerequisite, invitation from the Departmental Honors Committee and concurrent enrollment in Pol Sci 399.

Staff.

Psychology

Head of Department: Professor Richard T. Louttit. Professors D. Appley, M. Appley, Berger, Bogartz, Donahoe, Epstein, Feldman, Kates, Levinger, J. Myers, Raush, Southworth, Steiner; Associate Professors Averill, Balagura, Cashdan, C. Clifton (Associate Department Head), Dzendolek, Golann, Harmatz, Jarmon, Kriekhaus, Moore, Moss, N. Myers, Schumer, Staub, Trowill, Watt; Assistant Professors Aizen, Anderson, Ayres, Bean, Carlson, Chumbly, R. Clifton, Daehler, Danielson, Dorris, Eagly, Eichelman, Emrick, Fite, Gadlin, Kamil, Kerpelman, Lieberman, Pollatsek, Reisman, Royer, Simonson, Todd, Turner, Well, Willoughby.

Psychology 101 is the prerequisite entrance course for all psychology students. Both psychology majors and non-majors may then elect any of the following additional courses without further prerequisite: 141, 145, 201, 210, 220, 230, 260, 262, 263, 270, 280, 290, 301, 305, 311, 325.

Students interested in majoring in psychology should elect Psychology 141 following completion of Psychology 101 and may then pursue a general psychology major or one designed for those preparing for graduate study and professional careers in the field.

The *general psychology major* must take Psychology 101, 141 and 305. In addition, he must elect at least two courses from each of the following two groups: A: 210, 220, 230, and 250; B: 260, 270 and 280. "Enriched" sections of some of the above core courses will be offered for those students who desire more in-depth study of the material.

The Department requires a minimum of 24 credits and a maximum of 30 credits in courses numbered above 200. The maximum of 30 credits may be increased to 40 credits (including senior honors) with consent of adviser. Students completing this major will fulfill the *Departmental requirements* for the Bachelor of Arts degree.

(Note: Students who have entered the B.A. program may elect the additional courses indicated below to complete a "career" major *without* shifting to a B.S. program or they may elect to become B.S. degree candidates if in the balance of their program they choose and are able to meet the *additional science requirements of the College*. Depending on their backgrounds, certain transfer students may have difficulty fulfilling these requirements in the time they have available. Students who are in doubt as to which major or degree programs to follow should discuss the available options with their Faculty Advisers.)

The *career psychology major* must elect the same program as the general psychology major as a minimum. In addition, such students should plan to elect Psychology 145 and at least one laboratory course from each of the following two groupings: A: 211, 221, 222, 231, and 251; and B: 261, 271, 281, and 282. (Psychology 145 (Statistics) is prerequisite for all of the laboratory courses except 222, 231, and 251.)

These laboratory electives must be taken in proper sequence with their associated non-laboratory prerequisites or corequisites. Students completing this major will fulfill the *Departmental requirements* for either the Bachelor of Arts or the Bachelor of Science degree.

Students in the "career" program (either B.A. or B.S.) who are otherwise eligible will be encouraged to participate in the Honors Program in their junior and senior years.

Selected majors in either program may from time to time be invited to participate in Special Problem programs, the Department's cooperative teaching program or both.

101 (I), (II). **ELEMENTARY PSYCHOLOGY (D).** An introduction to the basic approaches and concepts of modern psychology. Examples from the areas of perception, conditioning, cognitive processes, social behavior, tests and measurements, and personality. Topically oriented discussion sections emphasize the heuristic value of these concepts and approaches in considering some of the problems of our society. 2 class hours, 1 1-hour discussion period. Mr. Gadlin, Staff.

141 (I), (II). **PSYCHOLOGICAL METHODS (D).** Introduction to the ways questions about behavior are formulated and then tested through experiments. Lectures and laboratory experiences involving concepts from many areas of psychology used to expose psychology majors to the procedures utilized in designing, conducting and reporting experiments. Prerequisite, Psych 101. 2 class hours, 1 2-hour laboratory period. Mr. Kamil, Staff.

145 (I), (II). **STATISTICS IN PSYCHOLOGY.** Introduction to statistical principles and techniques as applied to psychological data. 3 class hours, 1 1-hour laboratory. Staff.

201 (II). **PSYCHOLOGY OF ADJUSTMENT (D).** Problems of personality development and adjustment emphasized. Psychological nature of man, conflict, and thinking and adjustment. Prerequisite, Psych 101. Mr. Kates.

210 (I), (II). **SENSATION AND PERCEPTION (D).** Methods, data and theories of the functioning of various sensory systems. Topics include a survey of basic sensory processes in the cutaneous senses, audition, vision, gustation, and olfaction; and higher perceptual processes in selected senses. Prerequisite, Psych 101. Mr. Danielson, Mr. Dzenolett.

211 (II). **LABORATORY IN SENSATION AND PERCEPTION.** Selected laboratory exercises in audition and vision and a semester project chosen by the student, with the aid of the instructor, in some area of sensation or perception. Prerequisites, Psych 141 and 210. 2 2-hour laboratory periods. Credit 2. Mr. Danielson, Mr. Dzenolett.

220 (I), (II). **LEARNING AND THINKING (D).** A general survey of animal and human learning and performance. Topics include: factors affecting acquisition, generalization, discrimination, extinction, and transfer in animals and humans; memory; and higher cognitive processes in humans. Prerequisite, Psych 101. Staff.

221 (I). **LABORATORY IN HUMAN LEARNING.** Introduction to methods used in investigating rote verbal learning, concept formation, short-term retention, verbal conditioning, artificial language learning, motor-skills, and other phenomena in human learning and retention. Prerequisites, Psych 141 and 220. 2 2-hour laboratory periods.

Credit, 2. Mr. Chumbley, Mr. Clifton.

222 (II). **LABORATORY IN ANIMAL LEARNING.** Introduction to methods used in investigating classical conditioning and operant behavior primarily using laboratory animals as subjects. Topics studied in the laboratory include: Acquisition, generalization, discrimination, extinction, and transfer phenomena. Prerequisites, Psych 141 and 220. 2 2-hour laboratory periods. Credit, 2. Staff.

230 (I), (II). **MOTIVATION (D).**

Introduction to theories and research on the nature and determinants of motivation. Topics include instinct, behavior energization concepts, biological and acquired bases of emotions and motives, frustration, conflict and stress. Prerequisite, Psych 101. Mr. Trowill, Staff.

231 (II). **LABORATORY IN MOTIVATION.** Methods of investigating motivation, including both laboratory and field studies using human and animal subjects. Includes selected projects conducted individually and in small groups by members of the class. Prerequisites, Psych 141, 230. 2 2-hour laboratory periods. Credit, 2. Mr. Trowill, Staff.

242 (I), (II). **ADVANCED EXPERIMENTAL PSYCHOLOGY.** Instrumentation, methods and techniques of experimental psychology. Prerequisite, Psych 141. May be repeated for maximum of 6 credits. Staff.

245 (I). **STATISTICAL INFERENCE IN PSYCHOLOGY.** Application of statistical procedures to analysis of psychological data and to problems of measurement in psychology and related fields. Prerequisites, Psych 101, Psych 145, or Stat 121 and permission of instructor. 2 class hours, 1 2-hour laboratory period. Staff.

250 (I), (II). **PHYSIOLOGICAL PSYCHOLOGY (D).** Neural bases of behavior, current issues in physiological psychology; psychobiological investigations of learning, sensory processes, motivation, and instinctive behavior. Prerequisites, Psych 101 and Zool 101 or permission of instructor. Mr. Carlson, Mr. Feldman.

251 (I). **LABORATORY IN PHYSIOLOGICAL PSYCHOLOGY.** Development of statistical techniques used in physiological psychology, including animal neurosurgery, electrophysiological stimulation and recording, and assessment of drug-behavior interactions. Prerequisites, Psych 141 and 250. 2 2-hour laboratory periods. Credit, 2. Mr. Carlson, Mr. Feldman.

252 (II). **DRUGS AND BEHAVIOR.** The psychobiological foundations of drug-behavior interactions. The neural and neurochemical basis of behavior, basic pharmacology, drugs that affect mood and their mode of action, the psychological and physical bases of drug dependence and addiction, experimental approaches to psycho-pharmacology. Prerequisites, completion of four courses in each of the "E" and "D" categories, including Psych 101 and Zool 101. Mr. Feldman.

260 (I). **CHILD BEHAVIOR AND DEVELOPMENT (D).** Psychological development of the child, including theories, methods, and data of child behavior studies. Open to psychology majors only. Prerequisite, Psych 101. Staff.

261 (II). **LABORATORY IN CHILD BEHAVIOR AND DEVELOPMENT.** Selected experiments investigating perceptual, conceptual, learning, and social processes in children. Prerequisite, Psych 141 and 260. 2 2-hour laboratory periods. Credit, 2. Staff.

- 262 (I). CHILD PSYCHOLOGY (D).**
Psychological development of the child, including language, emotions, intelligence, social behavior, motivation, and personality. Not open to psychology majors. Prerequisite, Psych 101. Staff.
- 263 (II). PSYCHOLOGY OF ADOLESCENCE (D).**
The development and emotional, social and intellectual adjustment of the individual during adolescence. Prerequisite, Psych 101. Mr. Schumer, Mr. Willoughby.
- 265 (I). INTRODUCTION TO THE STUDY OF EXCEPTIONAL CHILDREN (D).**
Emphasis on the etiology, diagnosis, characteristics, education, and prognosis of deviations in mental, physical, and socio-emotional development. Prerequisites, Psych 101, 262, or permission of instructor. Mr. Kates, Mr. Lieberman.
- 270 (I), (II). PERSONALITY (D).**
Introduction to the scientific study of personality. Personality development, structure and dynamics from major theoretical orientations. Prerequisite, Psych 101. Mr. Staub, Mr. Simonson.
- 271 (II). EXPERIMENTAL STUDY OF PERSONALITY.**
Selected research projects in personality carried out by class members. Each student conducts one major project of his own in addition to the group projects. Prerequisites, Psych 141 and 270, which may be taken concurrently. 2 2-hour laboratory periods. Credit, 2. Mr. Epstein.
- 280 (I). SOCIAL PSYCHOLOGY (D).**
Introduction to the principles and study of social behavior. The psychological factors involved in attitude formation and change, communication and persuasion, and small group processes. Prerequisite, Psych 101. Staff.
- 281 (I). LABORATORY IN ATTITUDES AND OPINIONS.**
Methods and research concerning attitude formation and change, attitude and opinion measurement, communication and persuasion. Prerequisites, Psych 141 and 280 or permission of instructor. 2 2-hour laboratory periods. Credit, 2. Staff.
- 282 (II). LABORATORY IN GROUP BEHAVIOR.**
Methods and research concerning the behavior of individuals in groups. Interpersonal attraction, social interaction and influence, power and conflict, communication, group structure, leadership, and productivity. Prerequisites, Psych 141 and 280, or permission of instructor. 2 2-hour laboratory periods. Credit, 2. Mr. Levinger.
- 290 (I). INDUSTRIAL PSYCHOLOGY (D).**
Psychological principles underlying personnel selection and training, communication and decision-making in industry. Prerequisite, Psych 101. Mr. Moss.
- 301(I), (II). EDUCATIONAL PSYCHOLOGY (D).**
Psychological facts and principles of development, learning, and measurement as applied to educational situations. Prerequisite, Psych 101. 2 class hours, 1 2-hour laboratory period. Staff.
- 305 (II). HISTORICAL AND CONTEMPORARY SYSTEMS (D).**
General structure of psychological theory; analysis and comparison of historical systems in the tradition of British empiricism-associationism and Continental rationalism, and of derivative near-contemporary and contemporary mentalistic, functionalistic, and behavioristic systems. Prerequisite, Psych 101. Staff.
- 306 (I). COMPARATIVE PSYCHOLOGY.**
Emphasis on experimental investigations in a wide range of species. Topics include sensory and physiological systems, learning and early experience. Prerequisite, completion of four courses in each of the "D" and "E" categories, including Psych 101 and Zool 101. Miss Fite, Mr. Kamil.
- 311 (I). PSYCHOLOGICAL TESTS.**
Survey of tests of intelligence, aptitude, interest, personality, and adjustment. Test rationale, construction, characteristics, uses and evaluation emphasized. Prerequisite, Psych 101. 2 class hours, 1 2-hour laboratory period. Staff.
- 325 (I). ABNORMAL PSYCHOLOGY (D).**
Etiology, symptoms and therapy of behavior abnormalities including neuroses, psychoses, epilepsies, speech disorders, and mental deficiency. Prerequisite, Psych 101. Mr. Harmatz, Mr. Cashdan.
- 331 (I), (II). CLINICAL PSYCHOLOGY.**
Introduction to theoretical approaches and methods used in understanding and treating psychologically-disturbed individuals. Prerequisite, Psych 325 or permission of instructor. Mr. Epstein (I), Mr. Cashdan (II).
- 345 (II). INTRODUCTION TO QUANTITATIVE THEORIES OF BEHAVIOR (D).**
Introduction to quantification of theories of learning, retention, choice, perception and the interaction of individuals in group situations. Prerequisite, Psych 145, 305 or permission of instructor. Mr. Myers, Mr. Chumbley, Mr. Pollatsek.
- 365 (II). THEORIES AND PRACTICE IN COUNSELING.**
Theories, techniques and tests necessary in counseling and guidance. Practice in organization and evaluating relevant data in the analysis of illustrative cases. Prerequisite, Psych 270, or 311, or permission of instructor. 2 class hours, 1 2-hour laboratory period. Mr. Kates, Mr. Turner.
- 385 (I), 386 (II). SPECIAL PROBLEMS.**
For qualified seniors. Independent work on special problems or in certain fields of psychological interest. By arrangement with members of the department. Credit, 1-3. Staff.
- 387 (I), (II). READINGS IN PSYCHOLOGY.**
Survey of relevant research literature under guidance of a staff member who will direct the student's research problem. Open only to qualified juniors. By arrangement with members of the department. Credit, 1-3. Staff.
- 391 (I) and 392 (II). SEMINAR IN PSYCHOLOGY.**
For qualified juniors and seniors. A survey and critical evaluation of the literature pertaining to selected topics in psychology. By permission of the department. Credit, 1-3. Staff.
- 395 (I). HONORS SEMINAR.**
For qualified junior psychology majors. Will survey the research areas of psychology represented in the department. Intended for juniors who will work on an honors thesis during their senior year. Credit, 1. Staff.

399 (I), (II). SENIOR HONORS THESIS.

For seniors selected to do individualized research with faculty. Students are nominated to honors program during spring semester of their junior year. Students selected must take this course for two consecutive semesters. No credit given until completion of second semester of work. *Credit, 6. Staff.*

Rhetoric

Director of Program: Professor Walker Gibson (English). *Associate Director:* Professor Karl Wallace (Speech). Professors Frank, Haven, Koehler, Weston (English); and Reid, Sillars (Speech). Associate Professors Bagg, Clayton, Silver (English); and Bevilacqua, Blankenship, Brown, Saveroid, Shelby, H. Stelzner (Speech). Assistant Professors Cameron, Harrington, P. Hicks, B. Hunt, Jayne, Jorgans, Leheny, Louis, Lyons, Moran, Shadoian, Sitter, Wolff (English); and Conville, Cronen, Malton, W. Price, S. Stelzner, Stewart, Stromgren (Speech). Instructors Adams, DiMarco, C. K. Smith, E. Smith (English); and Johnson, Lagrave, Mihevic, R. Price, Rottenberg (Speech). Lecturer Kenseth (English).

With certain exceptions for advanced placement, the University Core in Rhetoric requires the completion of one course in Group I, and one other course in Rhetoric. The requirement is expected to be completed by the end of sophomore year.

Within the standard two-semester sequence in composition and speech, the Program in General Rhetoric offers flexibility and choice, as well as a systematic theory of language. It asks two questions: How do we use words and styles to express ourselves and communicate with our world? How can we improve this expression and communication, and what do we mean by "improvement?" The Program confronts at a basic or unspecialized level, many of the "languages" through which people share their experience — oral and written, kinesics, film, electronics. Fuller details on the courses in the Program are available at the Rhetoric office, 308C Bartlett Hall.

GROUP I

100 (I), (II). LANGUAGE AND WRITING (B).

How words and styles are chosen to express ourselves and our world, with particular attention to the written language. Varied opportunities for written expression, on different subjects for different purposes and audiences. Emphasizes responsible choice in the language used in both academic and everyday life.

Mr. Gibson, Staff.

110 (I), (II). LANGUAGE AND SPEAKING (B). The process and act of communication, emphasizing meaning and the principles of and the choices available in the use of language. The rhetorical nature of our world, and the means and ends of effective and ethical communication. The concepts of communication, meaning, and language; and the principles and problems of informative and persuasive speaking. Required: three to four prepared speeches, and three to four written assignments.

Mr. Price, Staff.

GROUP II

140 (I), (II). VOICES OF IMAGINATIVE WRITING (B).

Various kinds of verbal imaginative expressions in our culture — rock lyrics and modern poems, short fiction, drama — to enable more articulate and critical reading and more resourceful and daring writing. Exercises in critical reading or analysis balanced by frequent "creative" writing activities in various genres; "playing" at self-expression and self-definition.

Mrs. Cameron, Staff.

145 (I), (II). CRITICISM AND THE THEATRICAL ARTS (B).

An opportunity to sharpen critical judgment about theatre. Aims at development of informal criticism into well-reasoned judgments of theatrical art, using as subject matter current local offerings in theatre, film and dance, and participation in laboratory projects.

Mr. Stewart, Staff.

150. COMPARATIVE MEDIA (B).

A team-taught exposition of the stylistic range of four media — novel, television, drama, and film — through analysis of a single "work of art" to determine why a specific medium was chosen, how a theme was modified for compatibility with a medium, how the range of aesthetic approaches affects content and form. Emphasis on written evaluation of the capabilities of media to reveal and interpret aspects of reality.

Mr. Mitchell, Staff.

160 (I), (II). THE ART OF RHETORICAL DISCOURSE (B).

Explores the key concepts and problems in public communication. Problems and concepts traced from classical times through contemporary events. Such topics as: How are the ethics of communication influenced by political theory? What is acceptable as proof? What is the function of speaker "image" in communication? At least three papers, a mid-term and a final exam.

Mr. Bevilacqua, Staff.

165 (I), (II). MODERN PUBLIC DISCOURSE (B).

The analysis of contemporary rhetorical discourse; how it works and why it sometimes fails. Emphasis on oral political discourse, but a wide variety of communication situations are studied to discover the relationship of source, message and receiver. The interrelation of language and thought with the environment in which they occur examined through lectures, discussion, films, tapes, and multi-media presentations. *Mr. Sillars, Staff.*

170 (I), (II). THE PROCESS OF COMMUNICATION (B).

The basic processes and elements involved in communication. Communicative purposes, settings, and forms; approaches to the study of communication. Units on the process of communication, language, and speech behavior, interpersonal communication, and public communication. Lectures, discussion, papers.

Mr. Price, Mr. Reid, Staff.

175 (I), (II). THE RHETORIC OF MODERN MEDIA (B).

With attention to comparison and contrast, examines television, film, print, and various aural media forms. Analysis of specific case examples. Classical skills expanded to consideration of "McLuhanesque" thought.

Mr. Johnson, Staff.

180 (I), (II). THE RHETORIC OF FILM (B). The process of communication focusing on the languages of film. Emphasis on relationships between techniques and meaning in film and the ways film uses the rhetorical methods of oral and written language. Each student views a significant number of films, reads related essays, writes frequent papers, and has an opportunity to write a brief scenario or (in some cases) make a short film. Mr. Harrington, Staff.

RELATED COURSE:

AFRO-AM 152. BLACK RHETORIC.

Slavic Languages and Literatures

Head of Department: Associate Profesor Maurice I. Levin. Professor Ivask; Associate Professors Rothstein, Tikos; Assistant Professors Lake, Ostro-rog; Instructor Stawiecki; Lecturer Cade.

RUSSIAN

110 (I), 120 (II). ELEMENTARY RUSSIAN. Grammar, exercises in composition and conversation, selected readings. No previous language training required. 3 class hours, 1 laboratory hour.

119 (I), 129 (II), 139 (III). RUSSIAN READING COURSE.

Intensive study of Russian grammar. Emphasis on developing reading ability only. No previous language training required.

130 (I), 140 (II). INTERMEDIATE RUSSIAN (140:C).

Review of fundamentals of grammar followed by more advanced study of grammatical structure and idiom. Composition, conversation and readings in Russian fiction. Prerequisite, Russ 120 or equivalent.

149 (II). RUSSIAN EXPOSITORY PROSE.

Readings in non-literary Russian texts from a wide variety of scientific and technical fields. Emphasis on developing reading skill in the student's field of specialization. Prerequisite, three semesters of Russian or equivalent.

201 (I). RUSSIAN CULTURE.

Russian geographical, historical, literary, religious, philosophic and artistic life as a means to assess Russian cultural progress. Conducted in English.

253 (I). DOSTOEVSKY (C).

Historical and literary background. Close text analysis. Student reports. Readings of selected works in the original required of Russian majors. Prerequisite, junior standing.

254 (II). TOLSTOY (C).

Historical and literary background. Close text analysis. Student reports. Readings of selected works in the original required of Russian majors. Prerequisite, junior standing.

255 (I). MASTERPIECES OF RUSSIAN LITERATURE IN TRANSLATION (C).

Selection from classics of Russian romanticism and

realism culminating in the novels of Dostoevsky and Tolstoy. Prerequisite, junior standing.

256 (II). RUSSIAN DRAMA (C).

Russian drama in the originals from the beginnings to the establishment of a national repertoire and theatre. Plays from Fonvizin to Gorky. Prerequisite, Russ 262 or equivalent.

257 (II). SOVIET LITERATURE (C).

Beginnings and development of Soviet prose, drama and criticism from Gorky to the present. Conducted in English. Majors required to do research in Russian. Prerequisite, junior standing.

258 (II). RUSSIAN POETRY.

Russian poetry in the originals. Nineteenth century to the present. Prerequisite, Russ 262 or equivalent.

259 (I). THE SLAVIC PEOPLES, THEIR LANGUAGES AND CIVILIZATIONS.

A survey of the historical, social, intellectual and cultural evolution of the Slavic peoples from the earliest times to the present. Emphasis on the non-Russian Slavs. Conducted in English.

261 (I), 262 (II). ADVANCED RUSSIAN.

Advanced grammar, building vocabulary and improving reading ability through selections from the Classical and Soviet Periods. Composition and classroom discussions in Russian on reading materials. Prerequisite, Russ 140 or equivalent. Departmental requirement for Russian majors.

264 (II). SCIENTIFIC RUSSIAN.

Intensive experience in translating scientific, technical, academic and journalistic articles. Prerequisite, Russ 140 or equivalent.

266 (II). RUSSIAN PHONETICS.

Detailed analysis of the Russian sound system. Articulation and intonation treated largely in comparison with the sound system of English. Recommended for those preparing to teach Russian. Prerequisite, Russ 262 or equivalent.

271 (I), 272 (II). RUSSIAN CONVERSATION.

Devoted to acquiring a conversational vocabulary and to developing fluency in speaking Russian. Prerequisite, Russ 140 or equivalent. Departmental requirement for Russian majors.

281 (I), 282 (II). RUSSIAN STYLISTICS.

The style of Russian literary works. Practical application of grammatical principles and intensive study of idiomatic expressions. Prerequisite, Russ 262 or equivalent. Departmental requirement for Russian majors.

291 (I), 292 (II). INTRODUCTION TO RUSSIAN LITERATURE.

Survey course conducted in Russian. Readings in Russian, written reports. Prerequisite, Russ 262 or equivalent. Departmental requirement for Russian majors.

310 (II). THE TEACHING OF RUSSIAN.

Analysis of the major linguistic problems facing the teacher of Russian and the methods used in solving them. Prerequisite, Russ 365 or permission of instructor.

SLAVIC LANGUAGES AND LITERATURES

319 (I). PUSHKIN.

The most important works of Pushkin, prose and poetry: *Eugene Onegin*, *Boris Godunov*, *The Captain's Daughter*, *The Bronze Horseman*, *Poltava*, and others. Facility in speaking and writing Russian required. Conducted on a seminar basis; each student actively participating.

320 (II). GOGOL.

The most important works of Gogol: *The Inspector-General*, *Dead Souls*, *The Overcoat* and selected passages from his *Correspondence with Friends*, and other works. Facility in speaking and writing Russian required. Conducted on a seminar basis; each student actively participating.

331 (I). NINETEENTH CENTURY RUSSIAN CRITICISM.

Criticism of the nineteenth century: Belinsky, Chernyshevsky, Dobrolyubov, Pisarev and others. Facility in speaking and writing Russian required. Conducted on a seminar basis; each student actively participating.

363 (II). HISTORY OF THE RUSSIAN LANGUAGE.

Historical phonology and morphology of Russian; emphasis on the development of the Russian literary language. Prerequisite, proficiency in Russian.

365 (I). STRUCTURE OF RUSSIAN.

Descriptive analysis of the morphology of contemporary standard Russian with additional emphasis on selected problems of derivation. Prerequisite, proficiency in Russian.

366 (II). CONTRASTIVE STRUCTURES OF RUSSIAN AND ENGLISH.

Contrastive analysis of Russian and English. Emphasis on those elements of Russian structure that differ significantly from English. Prerequisite, Russ 365.

385, 386. SPECIAL PROBLEMS.

Individual study of a selected problem for qualified students. By arrangement with members of the department. *Credit, 1-3.*

POLISH

110 (I), 120 (II). ELEMENTARY POLISH.

Oral and written exercises, pronunciation and grammar, reading of selected works. No previous language training required. 3 class hours, 1 laboratory hour.

130 (I), 140 (II). INTERMEDIATE POLISH (140:C).

Review of grammar, composition and selected readings. Prerequisite, Polish 120 or equivalent and permission of instructor.

Sociology

Chairman of Department: Professor Thomas O. Wilkinson. Professors Driver, Gordon, Killian, Korson, Page, Speier; Associate Professors Chilton, Golden, Hollander, Lewis, Manfredi, Mehta, Park, Piedmont, Platt, Simpson, Sutton, Tausky, Wilson, Yaukey; Assistant Professors Chevan, Faulkner, Hewitt, O'Rourke, Roof, Stokes; Instructors Harris, Kaplan, Lincoln.

Sociology majors are required to take Sociology 101 (Introductory) and a minimum of eight to a maximum of ten 200-level or above courses selected from among the offerings of the Sociology Department. Introductory Sociology is recommended for all students who anticipate taking Sociology courses at the 200-level or above. Sociology majors, especially those who are considering graduate studies, are strongly advised to take a statistics course, Sociology 282 (Sociological Theory), and Sociology 295 (Research Methods).

101. INTRODUCTION TO SOCIOLOGY (D).

The fundamental terminology of sociology. Intensive discussion of selected topics from a sociological point of view.

222. SOCIOLOGY OF EDUCATION (D).

Social and economic interrelationships of education, stressing social class and social change. Attention to developing countries and minority people.

224. HIGHER EDUCATION IN AMERICA (D).

The organizational context within which college and post-graduate education takes place. Historical and international comparison, with review of the relevant discussions of individual development; higher education in its broader relationship to other human activities.

231. SOCIOLOGY OF AGING (D).

Aging as a social phenomenon in the United States and Massachusetts with emphasis on the elderly population. Topics include biological, psychological and social factors in the aging process, the demographic and ecological conditions of aging, the problem of retirement, and public policy and politics as they relate to old age.

233. POLITICAL SOCIOLOGY (D).

The relationships between the political and non-political institutions and values of society. The formal and informal aspects of the exercise of power, its social and cultural setting. Social movements: their appeal, ideology and social base. Extremism, pluralism and totalitarianism. Participation and pseudo-participation. The cults of personality, charisma and propaganda. The culmination of social conflict: coercion, its processes and techniques.

247. SOCIAL STATISTICS.

An introduction to principles and techniques with reference to application in sociology.

251. URBAN SOCIOLOGY (D).

A comparative analysis of cities and of urbanization with reference to demographic characteristics of urban populations, urban ecology, and urban social structure.

252. URBANIZATION AND THE CITY (D).

A comparative analysis of world urbanization, its trends, causes and consequences. Regional variations in the nature of urbanization and trends in major countries analyzed and related to major aspects of the spatial and social structure of cities. Prerequisite, Sociol 101.

253. SOCIOLOGY OF LAW (D).

The institution of law in society, with reference to variations among societies in systems of law, the develop-

ment of English and American law, the structure of the legal profession, and the relationships between the legal system and other aspects of society.

254. INDUSTRIAL SOCIOLOGY (D).

The role, status, and function of the worker in the industrial community. A consideration of changing technology and the adjustment made in the industrial community.

255. SOCIOLOGY OF RELIGION (D).

The relationship of religious beliefs and institutions to cultures and societies.

256. RACE RELATIONS (D).

The social, economic and political aspects of racial and ethnic problems in the United States; briefer consideration of similar problems in Africa and Asia.

257. THE FAMILY (D).

The development of the customs of courtship and marriage and the contemporary family. The basic causes of changes and trends of the family.

258. SOCIAL INTERACTION (D).

Social interaction in the context of groups, especially small groups. The dynamics of interaction process as the basis for group development. Attention to the emergence of normative and affective subsystems and to role differentiation.

259. SOCIAL STRATIFICATION (D).

The factors associated with institutionalized inequality in social life. A consideration of class, status, and power in American society.

261. POPULATION PROBLEMS (D).

An analytical study of population composition; the causes and consequences of changes in the basic demographic variables: fertility, mortality, and migration.

262. THE DEMOGRAPHY OF MINORITY GROUPS (D).

Demographic and ecological factors affecting relationships between ethnic, racial, and religious groups. The demography of minorities from a comparative perspective, drawing upon materials from various nations. Prerequisite, Sociol 256.

265. POPULATION OF JAPAN.

A demographic survey of the history and development of modern Japan. Emphasis on (1) the similarities and contrasts between Japan's demographic transition and that of the West, and (2) the relevance of Japanese experience for contemporary underdeveloped nations. Prerequisite, Sociol 261 or equivalent.

266. COMMUNITY AND HUMAN ECOLOGY (D).

The origin, development, location, junctions, and systems of communities. Ecological process of change, invasion and succession, centralization and decentralization, concentration, suburbanization, and patterns of residence and segregation of racial, ethnic, and religious groups are comparatively analyzed.

270. SOCIAL STRUCTURE OF INDIA (D).

The origins, distributions, and cultural traits of the major groups in India. Attention to marriage, family, caste patterns, and positions in the economic and political system.

272. SOCIAL CHANGE (D).

Changes arising from culture contact, social reform, and technical inventions. Planned and unplanned change, particularly in underdeveloped countries.

275. SOCIAL PROBLEMS (D).

The distribution and interrelationships among some types of deviance and disorganization; crime, mental disorders, addiction, suicide, family tension. Theories of causation; research projects.

278. CRIMINOLOGY (D).

The nature of crimes and the factors underlying criminal behavior. The machinery of justice; the law, courts, police systems, and correctional institutions.

280. SOVIET SOCIETY (D).

Survey of the major social institutions, process and problems of Soviet Society; official and popular values and norms, stratifications, social controls, the family, types of socialization and social problems (i.e., crime, delinquency, the misuse of leisure, rural migration, etc.). The nature and usefulness of various theoretical models of Soviet Society.

282. SOCIOLOGICAL THEORY (D).

Contributions of European and American writers who have concerned themselves with theories of the origin, growth, and development of human social organization.

285. COMPLEX ORGANIZATIONS (D).

An analysis of the processes leading to the formation, stability and instability of complex organization. Theoretical and empirical work related to these processes.

286. SOCIOLOGY OF MEDICINE (D).

Survey of the field of medical sociology, and examination of the medical institution using sociological concepts. Organization and utilization of medical care, social epidemiology, interaction between the community and the medical institution, patient-practitioner interaction.

287. SOCIOLOGY OF MENTAL DISORDERS (D).

Influence of social factors on diagnosis, treatment, and possible etiology of mental disorders. Application of sociological concepts and methods in considering: nature and extent of mental illness, mental hospitals, and the community in rehabilitation.

292. BACKGROUND TO THE STUDY OF SOCIAL WELFARE (D).

The historical development and current status of British and American concerns about poverty in the context of the Industrial Revolution; sociological perspectives concerning differentials in access to economic security and social rewards, and problems of measurement and planning as related to social policies.

293. ISSUES IN SOCIAL POLICY PLANNING (D).

Primarily for upper division students. Focuses upon (1) systematic policy planning, the role of research and development and the role of the scientific community in domestic policy programming; and (2) selected substantive issues which draw heavily from social and geographical distributions of relative access to the valued goods, services and rewards in the society and consideration of mobility processes upon the redistribution of such access. Prerequisite, permission of instructor.

295. RESEARCH METHODS.

Research methods and techniques employed in sociology. Each student is required to design a research project of limited scope.

296. SEMINAR IN RESEARCH.

Guided research on problems of sociological interest. Research projects using the tools and logic of sociological research. Prerequisite, Sociol 295.

360. TECHNIQUES OF DEMOGRAPHIC ANALYSIS (SEMINAR).

The methods for gathering population data and the uses of these data to measure mortality, fertility, migration and population composition. The theoretical interrelations among these factors. Methods for making population estimates and projections. Prerequisite, Sociol 261 or a course in statistics, and permission of instructor.

363. FERTILITY AND SOCIETY (SEMINAR).

A review of past and present trends in fertility on a worldwide basis, an analysis of the social determinants and consequences of these trends, and an assessment of the likely future trends. Prerequisites, Sociol 261 and permission of instructor.

375. SOCIOLOGY OF LITERATURE (SEMINAR). Literature as a source of information about society, in particular social values and norms, social change and conflict and the various relationships between society and the individual. The seminar also examines the conditions under which literature reflects or distorts social realities and the interaction between literary products and their social environment. Permission of instructor required.

385, 386. SPECIAL PROBLEMS.

Individual study of a selected problem for qualified students. By arrangement with members of the department.

Credit, 1-3.

390, 391. SEMINAR IN SOCIOLOGY.

A survey and critical evaluation of the literature pertaining to selected topics in sociology. For juniors and seniors. Permission of instructor required.

Soviet and East European Studies Program

Chairman of Program: Assistant Professor Karl Ryavec. Members of the Committee on Soviet and East European Studies: Joel Halpern (Anthropology), Vaclav Holesovsky (Economics), Paul Hollander (Sociology), Robert Jones (History), Maurice Levin (Slavic), Stanley Radosh (Slavic Bibliographer, Library), and Karl Ryavec (Political Science).

The Soviet and East European area is viewed in this Program from the perspective of several disciplines. Requirements for a major are:

- 1) Proficiency in a relevant language (usually Russian) at a level adequate to enable the student to conduct research in that language;

- 2) successful completion of ten courses (including the third year of the language) dealing with the area in a minimum of three disciplines to be chosen from Anthropology, Economics, History, Political Science, Slavic Languages and Literatures, and Sociology;
- 3) two courses in modern European history.

The faculty above and approximately ten other faculty members in various departments teach courses on the area. The approximate total of courses is presently 34, 15 of which are language courses.

Questions regarding the program may be directed to Professor Ryavec in 334 Thompson Hall or Professor Levin, Head of the Department of Slavic Languages and Literatures in 438 Herter Hall.

Speech

Chairman of Department: Professor James E. Lynch. Professors Bevilacqua, Kraus, Melrose, Niedeck, Nober, Reid, Tolhurst, Wallace; Associate Professors Abramson, Blankenship, Brown, Savereid, Shelby, Sillars, Stelzner, Thomas, Young; Assistant Professors Bednerik, Bohn, Brann, Conville, Cronen, Fiala, Harper, Hopper, Mahnken, Matlon, Meyer, Nerbonne, Nielsen, Peirce, W. Price, Scott, C. Seymour, H. Seymour, Stewart, Stromgren, Tokay, Weaver; Instructors Craft, Gillispie, Johnson, LaGrave, Mihvec, R. Price; Lecturers Lerea, Rood.

See the Rhetoric Program for other courses sponsored by the Department of Speech.

GENERAL

250. SPEECH AND LANGUAGE THEORY (D). The nature of speech and language and the process involved in acquiring, understanding and producing speech and language.

350. INTRODUCTION TO SPEECH RESEARCH. Introduction to research methods, bibliographical resources, and professional writing in the field of speech. Prerequisite, 12 credits in speech.

385, 386. SPECIAL PROBLEMS.

Individual study of a selected problem for qualified students. By arrangement with members of the department.

Credit, 1-3.

399. SENIOR HONORS.

COMMUNICATION DISORDERS

181. PHONETICS.

The physiological and acoustic processes involved in producing sounds and the use of the International Phonetic Alphabet in describing these processes.

182. INTRODUCTION TO COMMUNICATION DISORDERS.

The types and causes of communication disorders with emphasis on speech disorders.

283. ARTICULATION DISORDERS.

Basic principles and methods involved in the rehabilitation of articulation disorders. Emphasis on types of disorders, diagnosis and evaluation of disorders, and therapeutic procedures. Laboratory observation. Prerequisites, Speech 181 and 182. 3 class hours, 1 1-hour laboratory.

284. ANATOMY AND PHYSIOLOGY OF THE SPEECH AND HEARING MECHANISM.

The anatomy and physiology of the speech and hearing mechanism; consideration of respiration, phonation, resonance, articulation, and audition.

285. BASIC CLINICAL AUDIOLOGY.

The acoustics and physiology of hearing. The etiology and symptomatology of hearing loss. Selected diagnostic procedures. Supervised practice in audiometric testing. Prerequisite, Speech 182.

286. REHABILITATION OF THE

ACOUSTICALLY HANDICAPPED.

Techniques of speech therapy, auditory-training, and speech reading for hard of hearing children and adults; multi-sensory approach to language development. Laboratory practice under supervision. Prerequisite, Speech 285. 2 class hours, 1 3-hour laboratory period.

287. FUNDAMENTALS OF HEARING AND SPEECH SCIENCE.

Investigation of physiological, acoustic and psychological correlates of speech production, transmission and reception. Exercises in the application of laboratory methods. Prerequisites, Speech 181 and 284. 2 class hours, 1 2-hour laboratory.

288. CLINICAL PRACTICE.

Supervised experience in therapy with individuals having speech and hearing disorders. May be repeated once. Prerequisite, permission of instructor.

Credit, 1-3 per semester.

289. COMMUNICATION PROBLEMS OF THE DEAF AND HARD OF HEARING.

Physical, psychological, social, and education problems and needs of the hearing handicapped. Prerequisite, Speech 250.

290. STUTTERING.

Major theories of the etiology, diagnosis, and clinical management of stuttering. Prerequisite, Speech 289.

291. PEDIATRIC AUDIOLOGY.

Assessment and clinical management of infants and children with auditory disorders. Problems of differential diagnosis, screening techniques, conditioning procedures, and electrophysiologic methods. Parental guidance and employment of amplification with children. Prerequisites, Speech 285 and 286.

390. SEMINAR IN COMMUNICATION DISORDERS.

Special problems; include a choice of a) communication disorders and the teacher, b) communication disorders in geriatrics, c) communication disorders and medicine, d) the non-verbal child, e) electrophysiologic audiometry, and f) speech audiometry. Prerequisite, permission of instructor. 3 class hours, 1 3-hour laboratory period. May be repeated.

Credit, 3-9.

MASS COMMUNICATIONS

121. INTRODUCTIONS TO MASS COMMUNICATIONS (D).

Including history and development, structure, roles, and functions. Standards for evaluation of the mass media.

222. THE PROGRAM PROCESS IN RADIO.

The program processes in radio from original idea to finished program. Basic experience in creating, producing, and directing radio programs. 2 class hours, 1 2-hour laboratory period.

223. THE PROGRAM PROCESS IN TELEVISION.

The basic program process in television from original idea to finished program. Training and procedures involved in the technique of television production. Experience in creating and producing television programs. Evaluation of program forms. 2 class hours, 1 2-hour laboratory period.

224. CREATIVE TELEVISION

PRODUCTION/DIRECTION.

Advanced theories of television production and direction; creation and production-direction of experimental program. Prerequisite, Speech 223. 2 class hours, 1 2-hour laboratory period.

225. HISTORY AND DEVELOPMENT OF THE MOTION PICTURE.

Evolution of the motion picture as an international art form and social force. Analysis of form, technique and impact of film. Selected screening of representative film styles and content.

226. PRINCIPLES AND TECHNIQUES OF FILM MAKING.

The theory and principles of film making for the motion picture theatre and television. Experience in writing, directing, editing and sound recording of films. Evaluation of film techniques, form and content. 1 class hour, 1 4-hour laboratory period per week.

227. FILM THEORY AND CRITICISM (C).

Basic theories of film communication; various film modes and structures. Development of bases for evaluation of films according to communicative and aesthetic values. Prerequisite, Speech 225.

228. MASS MEDIA IN SOCIETY (D).

Mass media as a major force in the American society. Emphasis on cultural, economic, political and social effects. Prerequisite, Speech 121.

229. BROADCAST NEWS AND PUBLIC AFFAIRS.

Legal, ethical and practical considerations involved in selecting, preparing and presenting news broadcasts, news documentaries and other public affairs programming. Prerequisites, Speech 121 and 222 or 223. 3 class hours, field trips.

230. WRITING FOR THE MASS MEDIA.

The role and function of the writer and the message in the mass media. Communication significance of content and style elements in television, radio and film. Comparison with print media. Writing experience in all media. Prerequisites, Speech 121 and 222 or 223. 2 class hours, 1 2-hour laboratory per week.

231. PRACTICUM IN MASS COMMUNICATIONS. Individual and group projects designed to provide creative production and research experience in radio, television or film. Prerequisites, Speech 121 and 222. 5 laboratory hours per week. This course may be repeated to a total of 3 credits. *Credit, 1.*

232. BROADCASTING AND THE GOVERNMENT (D).

The role, function and effect of regulation on broadcasting. Prerequisite, Speech 121.

391. SEMINAR IN MASS COMMUNICATIONS. Analysis and discussion of major problems in the field of mass communications. Examination of current research. Prerequisites, 9 hours of courses in mass communications. May be repeated up to a total of 6 credits.

RHETORIC AND PUBLIC ADDRESS

201. PUBLIC SPEAKING.

Study and application of principles governing the composition and delivery of public speeches.

202. DISCUSSION.

The principles of group discussion and their application to major contemporary problems.

203. ARGUMENTATION AND DEBATE.

Study and application of reasoning and evidence as it is used in public deliberation.

204. PERSUASION.

The theory of persuasion and its application to the composition and delivery of persuasive speeches.

205. CLASSICAL RHETORICAL THEORY (C).

Major rhetorical theories from the emergence in ancient Greece to the late Roman Empire. Special emphasis is given to the Sophists, Plato, Aristotle, Hermagoras, Cicero, Quintilian, and St. Augustine. Prerequisite, permission of instructor.

206. EARLY MODERN RHETORICAL THEORY (C).

The impact of contemporaneous science, philosophy, and aesthetics on rhetorical theory from 1600 to 1900. Emphasis on the eighteenth century Rhetorical Renaissance. Prerequisite, Speech 205 or permission of instructor.

207. AMERICAN PUBLIC ADDRESS (D).

Reading and analysis of selected American speeches which have been influential in shaping our culture and history by reconstructing the circumstances under which they were given and by exploring the speaker's means of persuasion.

208. ADVANCED RHETORICAL COMPOSITION.

Intensive study of rhetorical invention, disposition, and style. Practice in the application of principles studied in classical and modern treatises by the preparation and revision of outlines and manuscripts for speeches. Prerequisite, permission of instructor.

209. BRITISH PUBLIC ADDRESS (D).

British speakers and speeches with special emphasis given to the reciprocal influence of rhetoric and the development of British culture, society and institutions.

210. MEDIEVAL AND RENAISSANCE RHETORICAL THEORY (C).

The developments in rhetorical theory from the beginning of the Middle Ages through the sixteenth century. Prerequisite, Speech 205 or permission of instructor.

211. CONTEMPORARY RHETORICAL THEORY (D).

Contemporary approaches to rhetorical theory and communication behavior. Attention to the experimental, analytical, critical, and philosophical methods. Prerequisite, Speech 205 or permission of instructor.

212. PARLIAMENTARY PROCEDURE.

The basic principles upon which a group operates, using parliamentary law and practical drill as the class organizes itself into an operating parliamentary body. 2 class hours. *Credit, 2.*

THEATRE AND ORAL INTERPRETATION

115. INTRODUCTION TO THE THEATRE (C).

Introduction to the art of the theatre: a survey of its aesthetics, elements, forms, and contributing artists; its influences and place in our culture.

135. FUNDAMENTALS OF PLAY PRODUCTION.

Methodology and techniques of play production; lectures, demonstrations, and practical laboratory work. The responsibilities and contributions of all participating artists examined in detail through intensive study of every aspect of production from script to stage. 2 class hours, 1 2-hour laboratory period.

140. INTRODUCTION TO STAGECRAFT AND DESIGN.

A survey of the nature and function of spectacle in the theatre. Attention to scenery, lighting, costume, and make-up. 3 class hours, 1 hour laboratory period.

152. ORAL INTERPRETATION.

Principles and techniques of reading aloud, using a variety of literary forms: verse, prose, and dialogue. Specific vocal needs relevant to the communication of meaning.

240. TECHNICAL PRODUCTION.

The materials and methods in construction for the stage. Prerequisites, Speech 115 and 140. 3 class hours, 1 2-hour laboratory period.

241. PRINCIPLES OF SCENE DESIGN.

An intensive study of the principles of scene design and the application of these principles to a series of design projects. Practical experience gained through laboratory work in scene painting and decoration. Prerequisites, Speech 115, 140. 3 class hours, 1 2-hour laboratory period.

242. DESIGN AND CONSTRUCTION OF COSTUME.

Silhouette, draping, color, texture, drafting of patterns, construction, and the application of these basic principles to a series of design projects. Prerequisites, Speech 115, 140. 3 class hours, 1 2-hour laboratory period.

243. ACTING I.

An orientation to the basic physiological and mental tools of the actor. Prerequisite, Speech 115. 2 class hours, 1 2-hour laboratory period.

244. ACTING II.

Character analysis and development with attention to the interrelationship of characters. Prerequisites, Speech 115, 243. 2 class hours, 1 2-hour laboratory period.

245. DIRECTING I.

An introduction to the theory and practice of stage direction. Emphasis on comprehension and mastery of the basic theatrical elements necessary to the creation of the stage picture. Prerequisite, Speech 115. 2 class hours, 3 laboratory hours.

246. DIRECTING II.

Problems in the interpretation and staging of various types of contemporary drama. Attention to rehearsal and performance procedures. Prerequisite, Speech 245. 2 class hours, 3 laboratory hours.

247. THEATRE HISTORY I (C).

The history of theatre in western civilization from its beginnings to 1642; the Classical, Medieval, and Renaissance theatres; the origins and development of drama, spectacle, theatre production, and theatre architecture.

248. THEATRE HISTORY II (C).

History of the theatre in western civilization. Emphasis on the eighteenth and nineteenth centuries, the Continental, English, American, and Modern Theatres.

251. ORAL INTERPRETATION OF CHILDREN'S LITERATURE.

Selection and interpretation of literary materials for children.

252. ADVANCED ORAL INTERPRETATION OF LITERATURE.

Concentration upon the philosophical and technical bases for reading the lyric poem, fiction, drama and documentary materials. Prerequisite, Speech 152.

253. CHILDREN'S DRAMA I.

Informal dramatics, without an audience, in classroom and recreation programs, serving children's need for creative outlets and furthering awareness, self-expression, self concepts, and social growth through imagination, pantomime, and improvised story dramatization. 3 class hours, observation of demonstration classes.

254. CHILDREN'S DRAMA II.

Formal aspects of children's theatre, the selection and presentation, by adults or older young people, of suitable plays for the child audience.

257. STAGE AND TELEVISION LIGHTING.

Principles, practices and equipment involved in stage and television lighting. Prerequisites, Speech 115, 140. 3 class hours, 1 2-hour laboratory period.

260. DRAMATIC FORM (C).

Possible critical approaches to a play with focus on the play script both as a formal unit and as a potential vehicle for dramatic production.

261. HISTORY OF DRAMATIC THEORY (C).

A survey of important trends and documents in the history of dramatic theory from Plato to 1900. Prerequisite, Speech 260.

262. THE BLACK PRESENCE IN AMERICAN DRAMA (C).

Selected works by American white and black playwrights, from mid-nineteenth century to the present, with emphasis on the image of the Afro-American.

264. HISTORY OF THE AMERICAN THEATRE AND DRAMA.

From its beginnings in the eighteenth century to the present day. The drama itself, the building in which it is performed, scenic effects, and the contributions of actor and director.

360. PLAYWRITING.

The problems of translating idea into dramatic action. Prerequisite, permission of instructor.

385, 386. SPECIAL PROBLEMS.

Individual study of a selected problem for qualified students. By arrangement with members of the department. *Credit, 1-3.*

Zoology

Chairman of Department: Professor Harold Rauch. Professors Bartlett, Fairbairn, Honigberg, Nutting, J. L. Roberts, Snedecor, Stuart; Associate Professors Andrews, Klingener, Levin, Ludlam, Mange, Moner, L. S. Roberts, H. D. Rollason, Sargent, Scudo, Snyder; Assistant Professors Dersham, Edwards, Kaulenas, Kunkel, O'Connor, Potswald, G. S. Rollason, Searcy, White, Wyse.

Each student majoring in Zoology must complete the following Zoology courses: 240 (Principles of Genetics); 360 (Cell Physiology); 221 or 223 or 227 (Comparative Anatomy or Histology or Embryology); 281 or 282 or 283 (Biology of the Lower Invertebrates or Biology of the Higher Invertebrates or General Parasitology); 246 or 335 or 337 or 350 (Population Genetics or Limnology or Ecology or Animal Behavior); and 366 or 370 or 380 (Vertebrate Physiology or Comparative Physiology or Developmental Biology).

He must attain proficiency in one of French, German, or Russian by completing a university language course at the 140 level or by achieving a score of 600 or better on College Entrance Examination Board test or on an equivalent test. Study of French, German, or Russian in high school, by itself, is not sufficient.

Students must also complete satisfactorily the following collateral courses: Botany 100 (Introductory Botany); Chemistry 111, 112 (General Chemistry); Chemistry 261, 262, 263, 264 (Organic Chemistry); Biochemistry 222 or 223 (General Biochemistry); Physics 141, 142 (Introductory Physics); and Statistics 231, 232 (Fundamentals of Statistical Inference) or Computer Science 131, 132 (Introduction to Computers and Programming, Survey of Computer Applications) or Mathematics 127, 128 (Calculus for Life and

Social Sciences). Students with a special interest in chemistry or chemical biology may, with the approval of the Chemistry Department, substitute Chemistry 113, 114 (General Inorganic Chemistry) for 111, 112; those with a special interest in physics may wish to substitute Physics 161, 162, 163 (General Physics) for 141, 142.

All students should enroll in a chemistry sequence in their freshman year, because subsequent courses in Organic Chemistry and Biochemistry are prerequisite to Zoology 360 which in turn is prerequisite to all of the courses in the 366-370-380 group.

Botany 100 should be elected in the fall of the freshman year, as it will serve to review major biological concepts prior to the Zoology major's first Zoology course (genetics) in the spring of the freshman year.

Zoology 101 (Introductory Zoology) is not required of Zoology majors. Students who have not studied biology in high school or who feel that their knowledge of introductory zoology is inadequate may enroll in the course or audit the lectures prior to or concurrently with their enrollment in Zoology 240.

The curriculum for those who plan to become certified secondary school biology teachers requires, in addition to the departmental requirements outlined above, Botany 125 (The Plant Kingdom) and 126 (New England Flora); Psychology 101 (Elementary Psychology), and either 263 (Psychology of Adolescence) or 301 (Educational Psychology); Education 251 (History of Education); Education 282 (Teaching Practicum). In addition, students accepted for the teaching "Block" must complete Education 285 (Practice Teaching), Education 312 (Methods in Science Teaching), and at least one elective course in Education. Students in the Secondary Education curriculum may, with the permission of their adviser, substitute Zoology 135 (Introductory Physiology) for the requirement of one of the 366-370-380 group provided that the substitution is not made before the student's junior or senior year, when his plans for secondary teaching have become firm.

101 (I), (II). **INTRODUCTORY ZOOLOGY (E).** Principles of zoology including cell structure and metabolism, heredity, development, behavior, evolution, ecology, and the anatomy and psychology of the major groups in the animal kingdom. Background for understanding current biological problems. 2 class hours, 1 3-hour laboratory. Staff.

135 (I), (II). **INTRODUCTORY PHYSIOLOGY (E).**

Circulation, respiration, digestion, metabolism, excretion, chemical and nervous coordination, muscular activity, and reproduction. Prerequisite, Zool 101. 2 class hours, 1 3-hour laboratory.

Mr. Dersham, Mr. Wyse.

137 (I), 138 (II). **ANATOMY AND PHYSIOLOGY.** A systematic approach to the study of the human body with integration of function and structure. Designed for students in nursing; not open to other majors. Prerequisite, Chem 110 or equivalent; credit only for full-year course. 3 class hours, 1 3-hour laboratory.

Credit, 4 per semester. Mrs. White.

145 (II). **HUMAN GENETICS (E).**

Introduction to human genetics emphasizing principles applicable to all species, specific knowledge of man, and scientific methodology. Topics include chromosomal and biochemical variations, blood groups, linkage, hypothesis testing, and gene frequency changes in populations. Not open to students majoring in biological sciences. Prerequisite, Zool 101. Mr. Mange.

176 (I). **ECOLOGY OF MAN (E).**

Man's interaction with the physical, chemical, and biological environment. Problems of population, food supply, pollution, resources, and human behavior, in relation to ecological theory. Specific problems in discussion section. 2 class hours, 1 75-minute discussion. Not open to students majoring in biological sciences. Prerequisite, 1 laboratory course in biological science. Mr. Ludlam.

200 (I), (II). **NATURAL HISTORY (E).**

Features of sky, climate, terrain, and organisms important in understanding the natural world and in teaching natural science. Laboratory includes methods of identification, collecting data, etc. Open to majors other than Elementary Education only as space permits. Prerequisite, Botany 100 or Zool 101. 1 class hour, 1 4-hour laboratory. (Also listed under Botany 200.)

Mr. Nutting, Mr. Edwards.

221 (I), (II). **COMPARATIVE VERTEBRATE ANATOMY.**

Structure and phylogeny of vertebrates. Laboratory work illustrates evolutionary trends and specializations and provides experience in dissection. Prerequisite, Zool 101 or 240. 2 class hours, 1 3-hour laboratory.

Mr. Klingener, Mr. Snyder.

223 (I), (II). **HISTOLOGY.**

Structure of cells, tissues, and organs as related to function; emphasis on the mammal; introduction to microtechnique. Prerequisite, Zool 101 or 240. 2 class hours, 1 3-hour laboratory. Mr. Potswald, Mrs. Rollason.

227 (II). **EMBRYOLOGY.**

A survey of embryonic development from a combined descriptive, comparative, and analytical point of view. Laboratories deal with descriptive and comparative phases of ontogeny, especially of amphibia, birds, and mammals. 2 class hours, 1 3-hour laboratory. Prerequisite, Zool 101 or 240. Mr. Kaulenas.

240 (I), (II). **PRINCIPLES OF GENETICS.**

Mechanisms of heredity in plants and animals, emphasizing transmission and action of genes, population genetics, and evolution. Not open to students who have passed Zool 145. Prerequisites, Chem 111, one semester of biological science. Mr. Levin, Mr. Rauch.

246 (I). **POPULATION GENETICS.**

Distribution of genes and genotypes within species, emphasizing theoretical models of static and evolving natural populations. Observational and experimental data considered, where available. Prerequisites, Zool 240, Math 123. Mr. Mange, Mr. Scudo.

275 (II). BIOLOGY OF PROTOZOA.

Morphology and physiology of protozoa, with emphasis on contributions made to basic problems of biology through study of these organisms. Prerequisites, Zool 101 or 240, 2 additional laboratory courses in biological sciences, Chem 262. 1 class hour, 1 2-hour and 1 3-hour laboratory. Mr. Honigberg.

281 (I). BIOLOGY OF LOWER INVERTEBRATES.

Survey of invertebrate animals based upon evolutionary and phylogenetic considerations. Includes the Protzoa, Porifera, Cnidaria, Platyhelminthes, Nematoda, Mollusca, etc. Prerequisite, Zool 101 or 240. 2 class hours, 1 3-hour laboratory. Mr. Nutting, Mr. L. S. Roberts.

282 (II). BIOLOGY OF HIGHER INVERTEBRATES.

Survey of invertebrate animals based upon evolutionary and phylogenetic considerations. Includes the Annelida, Arthropoda, Ectoprocta, Echinodermata, etc. Prerequisite, Zool 101 or 240. 2 class hours, 1 3-hour laboratory. Mr. Nutting, Mr. L. S. Roberts.

283 (I). GENERAL PARASITOLOGY.

Morphology, life cycles, and physiology of protozoan and helminth parasites, with emphasis on broad aspects of parasitism. Prerequisites, Zool 101 or 240, Chem 112 or 114. 2 class hours, 1 3-hour laboratory. Mr. Honigberg.

300 (I). VERTEBRATE ZOOLOGY.

History, relationships, patterns of distribution, classification of vertebrates, with emphasis on fishes. Laboratories include field trips. Prerequisite, Zool 101 or 240. 1 class hour, 2 2-hour laboratories. Mr. Andrews.

302 (II). ICHTHYOLOGY.

Morphology, ecology, and relationships of fishes, and their distribution in space and time. Prerequisite, Zool 221 or 300. 2 class hours, 1 3-hour laboratory. Mr. Andrews.

306 (II). ORNITHOLOGY.

Avian biology, including structural and functional adaptations, with particular emphasis on behavior. Laboratory includes field trips. Prerequisite, Zool 101 or 240. 2 class hours, 1 3-hour laboratory. Mr. Bartlett.

308 (II). MAMMALOLOGY.

Evolution, distribution, classification and ecology of mammals. Laboratory includes field trips, preparation of study material, and identification of local fauna. Prerequisite, Zool 221 or 300. 2 class hours, 1 3-hour laboratory. Mr. Snyder.

335 (II). LIMNOLOGY.

Inland waters, including geological, physical, chemical and biological aspects. Prerequisites, Bot 100, Zool 101 or 240, Chem 112 or 114, Physics 141. 2 class hours, 1 3-hour laboratory or field trip. Mr. Ludlam.

337 (I). ECOLOGY.

Introduction to descriptive and theoretical ecosystems, community, population, and behavioral ecology. The laboratory emphasizes ecologic principles and techniques. Prerequisites, Zool 101 or 240, Math 124, one semester of invertebrate zoology, preferably Zool 282. 2 class hours, 1 3-hour laboratory. Mr. Edwards, Mr. Ludlam.

350 (I). ANIMAL BEHAVIOR.

The biological bases of animal behavior. Analysis of the methods and objectives of current research. Prerequisite, Zool 101 or 240, and Psych 101 or 250. Mr. Sargent, Mr. Stuart.

360 (I), (II). CELL PHYSIOLOGY.

Modern trends in physiology with emphasis on chemical and physical properties of cells including cell ultrastructure and metabolism, permeability, muscle contraction and molecular biology. Prerequisites, one year of biology, Biochem 222 or 223. 2 class hours, 1 3-hour laboratory. Mr. Kaulenas, Mr. Kunkel, Mr. Moner, Mr. Searcy.

366 (I). VERTEBRATE PHYSIOLOGY.

Function of organs and organ systems in vertebrates. Not open to students who have passed Zool 135. Prerequisite, Zool 360 or Biochem 220 or 222 or 223. 2 class hours, 1 3-hour laboratory. Mr. Snedecor.

370 (II). COMPARATIVE PHYSIOLOGY.

Physiological principles involved in adaptations of animals to their environment; laboratory emphasis on experimental methods used to study adaptive mechanisms. Prerequisite, Zool 360. 2 class hours, 1 3-hour laboratory. Mr. J. L. Roberts.

380 (I), (II). DEVELOPMENTAL BIOLOGY.

Physiological and biochemical aspects of development. Laboratory includes seminars, discussions, and experimental work. Prerequisites, Biochem 222 or 223, Zool 360. 2 class hours, 1 3-hour laboratory. Mr. Kaulenas, Mr. Kunkel.

385, 386. SPECIAL PROBLEMS.

Individual study of a selected problem for qualified students. By arrangement with members of the department. Credit, 1-6.

399 (I), (II). SENIOR HONORS PROJECTS.

Individual study and research under the direction of a faculty member for highly qualified seniors. By invitation from the Director of Honors upon recommendation of the department. Credit, 6.

Note: Summer courses such as Invertebrate Zoology, Invertebrate Embryology, and Marine Ecology taken at the Marine Biological Laboratory, Woods Hole, Massachusetts or study at other biological field stations will be awarded 3 to 6 credits upon certification of satisfactory achievement in 6 to 12 weeks of study.

School of Business Administration

WENDELL R. SMITH, *Dean*

John T. Conlon, *Associate Dean*

Lawrence A. Johnson, *Assistant Dean*

Nelson E. Pion, *Assistant Dean*

Courses and major programs are listed under four departments in the School of Business Administration: Accounting, General Business and Finance, Management, and Marketing. Irrespective of any major selected, a certain "core" of courses is required of all students.

	<i>Credits</i>
Required "core" courses:	15
Accounting 110, or	
Management 110, Introduction to Computers for Business	3
Finance 201, Corporation Finance	3
*General Business 260, Law I	3
Management 201, Principles of Management	3
Marketing 201, Fundamentals of Marketing	3

*SBA majors are permitted to substitute Political Science 292, Politics, The Law and Judicial Behavior for General Business 260, Law I.

Elective courses shown in major programs are selected with the aid and consent of the student's adviser.

Accounting

Chairman of Department: Professor Carl Denmler, Jr. Professors Anderson, Backer, Corcoran, Lentilhon, Singer; Associate Professors Krzystofik, Morrison, Simpson, Stone; Assistant Professors Burch, Fitzgerald, Gosman, Motekat, O'Connell, Taylor, Zeisel; Instructors Ageloff, Clapper, Pion.

	<i>Credits</i>
Required "core" courses	21
Required courses in the major:	
Accounting 220, Financial Reporting Theory I	3
Accounting 221, Financial Reporting Theory II	3
A course or courses in at least two of the following three areas:	
1. Accounting 230, Cost Accounting, or Accounting 235, Managerial Cost Analysis	
2. Accounting 210, Business Applications of Computer, or Accounting 211, Business Information Systems	
3. Accounting 370, Federal Income Tax Procedures	
Electives sufficient to reach a minimum of 24 hours in accounting courses (including Accounting 120 and 130).	

A Business Law course in addition to the one required in the School core

Four elective courses outside the School

Additional electives to bring total to the 120 credits required for graduation. Note: Students planning to work in public accounting in New York state should elect a Finance course in addition to the one required in the School core.

110 (I) and (II). INTRODUCTION TO COMPUTERS FOR BUSINESS.

The BASIC and FORTRAN computer programming languages with emphasis on the use of the computer for business data processing and problem solving. (Also listed as Mgt. 110.) Staff.

120 (I) and (II). INTRODUCTION TO FINANCIAL ACCOUNTING.

Introduction to principles underlying the preparation of financial statements. Staff.

130 (I) and (II). INTRODUCTION TO MANAGERIAL ACCOUNTING.

Continuation of Accounting 120 with major emphasis on the development and application of accounting data for planning and control. Staff.

210 (I) and (II). BUSINESS APPLICATIONS OF COMPUTERS.

Basic business data processing methods with emphasis on general business problems and their application to the COBOL language. Prerequisites, Acctg. 120, 130 and Acctg./Mgt. 110. (Also listed as Mgt. 210.) Mr. Burch.

211 (I) and (II). BUSINESS INFORMATION SYSTEMS.

Data processing methods and design of file structures as they relate to business information systems. Emphasis on the role of the accountant and manager in the design and operation of the systems. Complementary methods of providing information to management for purposes of control, planning, and decision-making. Prerequisites, Acctg. 120, 130 and Acctg./Mgt. 110 or equivalent. (Also listed as Mgt. 211.) Mr. Burch.

220 (I) and (II). FINANCIAL REPORTING I.

Intensive examination of fundamental concepts underlying financial reporting. Current literature dealing with effects of alternative methods upon measurement of periodic income. Prerequisite, Acctg. 130.

Mr. O'Connell, Miss Motekat, Mr. Taylor.

221 (I) and (II). FINANCIAL REPORTING II

Continuation of Acctg. 220 and an introduction to consolidated financial statements of affiliated companies. Prerequisite, Acctg. 220. Miss Motekat, Mr. Simpson.

230 (I) and (II). COST ACCOUNTING.

Methods of cost analysis for job order, process, and standard cost systems, with emphasis on cost control and interpretation. Prerequisite, Acctg. 130.

Mr. Denmler, Mr. Krzystofik, Mr. Lentilhon.

235 (I) and (II). MANAGERIAL COST ANALYSIS.

Analysis of Cost-Volume-Profit relationships, cost behavior, budgeting and planning, responsibility accounting and control systems, behavioral aspects of budgets, divisional performance evaluation, inventory planning

and accounting aspects of capital budgeting. Prerequisites, Acctg. 120, 130 and basic calculus.

Mr. Gosman, Mr. Morrison, Mr. Zeisel.
263 (II). LAW IV.

Legal problems most commonly encountered by certified public accountants. Special attention to subjects currently included in CPA examinations. (Limited to seniors majoring in accounting.) Prerequisite, General Business 260. (Also listed as Gen. Bus. 263.)

Mr. O'Connell.
320 (I) and (II). FINANCIAL REPORTING III. Consolidation problems of merged firms. Application of interest to accounting problems. Both general price-level and specific price change problems. Problems of foreign operations and of firms in financial difficulty. Prerequisite, Acctg. 221. Mr. Gosman, Mr. Simpson.

335 (I). INVENTORY CONTROL. Mathematical modeling applied to control of inventory investments. Emphasis is also on the recognition of relevant costs for the development and solution of appropriate models. Prerequisites, proficiency with finite and infinitesimal calculus, probability theory, matrix algebra, computer programming, and operations research methodology, or permission of instructor.

Mr. Corcoran.
340 (I) and (II). AUDITING AND CONTROL. Basic principles of auditing with emphasis on theory, types of audits, duties and responsibilities of the auditor, audit programs and methods of internal control. Emphasis on the responsibilities of both the independent and internal auditor. Prerequisites, Accounting 221 and either 230 or 235. Mr. Krzystofik, Mr. Taylor.

360 (II). GOVERNMENTAL ACCOUNTING. Special features of budgetary and fund accounting as applied to municipalities, other governmental units and institutions, such as hospitals and schools. Prerequisite, Accounting 120. Mr. Anderson.

370 (I) and (II). FEDERAL INCOME TAX PROCEDURE. Federal income tax laws and regulations as they affect individuals; preparation of tax returns. Prerequisite, Accounting 120. Mr. Anderson, Mr. Fitzgerald.

371 (I) and (II). ADVANCED FEDERAL TAX PROCEDURES. A continuation of Accounting 370 emphasizing corporations, partnerships, estates and trusts, gifts and estate taxes, tax planning and research. Prerequisite, Accounting 370. Mr. Anderson, Mr. Fitzgerald.

380 (II). CPA PROBLEMS. Extensive practice in solution of problems for CPA examinations. Topics include: proper treatment of assets, liabilities and ownership equity; partnerships; consolidations; funds and cash flow; cost accounting and management uses of accounting information; and governmental accounting. Prerequisite, Accounting 320. Mr. Lentillon.

385, 386. SPECIAL PROBLEMS. Individual study of a selected problem for qualified students. By arrangement with members of the department. Credit, 1-3.

393 (I) and (II). SENIOR HONORS SEMINAR. Advanced study and research on selected topics in Business Administration and related disciplines. Available only to seniors with 2.8 average or better, and/or by permission of instructor. May be taken both semesters.

General Business and Finance

Chairman of Department: Associate Professor Alexander Barges. Professors Balintfy, Cheng, Ludtke, Osborn, Rivers; Associate Professors Belovicz, Bonsignore, Hartzler, Kaczka, Whiston; Assistant Professors Abranovic, Beals, Burak, Choate, Deets, d'Errico, Evans, Goldman, Katsh, Kumar, Pipkin, Plattner; Lecturer Flanders.

Curriculum in Financial Management	Credits
Required "core" courses	15
Required courses in the major:	15
Finance 210, Financial Institutions, or Economics 211, Money, Banking and Credit	
Finance 202, Problems in Business Finance I	
Finance 203, Problems in Business Finance II, or Finance 204, Models of Financial Analysis & Management	
Finance 220, Investments	
Finance 230, Principles of Insurance	
Electives in area of concentration, with a minimum of 9 credits in Business Administration	18
Electives outside of Business Administration and Economics	12

Curriculum in General Business	Credits
Required "core" courses	15
Required courses in the major:	6
Finance 210, Financial Institutions, or Economics 211, Money, Banking and Credit	
General Business 265, Business and Its Environment	
Electives in Business Administration	12
Electives in Economics beyond introductory course level	9
Electives outside Business Administration and Economics with a minimum of 9 credits from a list of selected courses	18
Curriculum in Business Administration with an Area of Concentration in Urban and Regional Studies	

	Credits
Required "core" courses	15
Required courses in the major:	15
Finance 210, Financial Institutions, or Economics 211, Money, Banking and Credit	
General Business 245, Metropolitan Transportation	
General Business 270, Real Estate and Urban Development	
General Business 272, Seminar in Urban and Regional Studies	
Environmental Design 274, or Environmental Design 273, City Planning History, or	
Environmental Design 244, Broad Survey of the History of the Designed Human Environment	

Specialization Electives:	24	Credits
General Business 242, Public Service Corporations		15
General Business 265, Business and Its Environment		6
General Business 385 and 386, Independent Study and Research		12
Economics 281, Regional Economics		15
Economics 282, Urban Economics		15
Economics 314, State and Local Public Finance		12
Government 324, Metropolitan Politics		12
Sociology 251, Urban Sociology		12
History 331, Social History of the United States		12
History 337, The City in the Modern United States		12
Geography 260, Economic Geography		12
Geography 270, Urban Spatial Organization		12
Geography 280, Political Geography		12
Electives outside of Business Administration and area of specialization	6	
<i>Curriculum in Business Administration and Quantitative Methods</i>		
Freshman Mathematics Requirements:		
Desirable but not required that persons considering this major elect the Mathematics 123, 124 sequence in place of Mathematics 116, 117.		
	<i>Credits</i>	
Required "core" courses	15	
Required courses in the major:	12	
General Business 250, Administrative Statistics		
General Business 253, Introduction to Management Science		
General Business 254, Topics in Management Science		
General Business 256, Management Science Application and Practicum		
Specialization Electives:	21	
12 credit hours from a list of quantitative electives		
9 additional credit hours in Business Administration and Economics		
Electives outside of Business Administration and area of specialization	12	
<i>Curriculum in Business Administration and Economics</i>		
	<i>Credits</i>	
Required "core" courses	15	
Required courses in the major:		
Finance 210, Financial Institutions, or		
Economics 211, Money, Banking and Credit		
Economics 201, Intermediate Microeconomic Theory		
Economics 214, Macroeconomic Theory and Business Cycles		
Electives in Business Administration and Economics, with a minimum of 12 credit hours in Economics	24	
Electives outside of Business Administration and Economics	12	
<i>Curriculum in Business Administration and (Environmental field outside Business Administration and Economics)*</i>		
Required "core" courses		15
Other required courses in Business Administration and Economics (to be selected specifically by the student and his adviser for each individual program)		6
Electives in Business Administration and Economics		12
Other Electives (all may be elected from specialized field)		15
Electives outside of Business Administration, Economics and specialized field		12
*At least 48 hours must be taken in Business Administration and Economics courses.		
FINANCE		
201 (I) and (II). CORPORATION FINANCE. Corporate financial behavior; appraisal of factors affecting decision-making regarding sources and application of funds; introduction to capital budgeting and cost of capital problem. Prerequisite, Accounting 125 or permission of instructor.		Staff.
201 (I). PROBLEMS IN BUSINESS FINANCE I. Short- and intermediate-term financing; decision-making under uncertainty regarding needs and sources of funds. Prerequisite, Finance 201.		Staff.
203 (II). PROBLEMS IN BUSINESS FINANCE II. Long-term financing, capital budgeting, reserves and dividend policy, pensions, company expansion, merger and consolidation, reorganization. Prerequisite, Finance 201.		Staff.
204 (I) and (II). MODELS OF FINANCIAL ANALYSIS AND MANAGEMENT. An analytical approach to the study of financial management. Emphasis on theoretical topics of financial decision-making. Through the use of mathematical, statistical and computer simulation methods, various financial decision-making models are made explicit in their assumptions, rigorous in their construction, and testable in their implications. Prerequisite, Finance 201 and the SBA required mathematics and computer courses.		Mr. Cheng, Mr. Kumar.
210 (I) and (II). FINANCIAL INSTITUTIONS. The American financial system and functional relationships between financial institutions and economic activities of households, business firms and governmental units. Prerequisites, Econ. 125 and Accounting 125.		Mr. Choate, Mr. Ludtke.
220 (I). INVESTMENTS. Development of the general theory of investment with emphasis on the individual investor; practical application of the techniques to real world problems.		Mr. Deets.
221 (II). THEORY OF INVESTMENT ANALYSIS. Detailed investigation into contemporary investment strategies; emphasis on the theoretical, with portfolio analysis and random walk being the chief topics. Prerequisite, Finance 220 or permission of instructor.		Mr. Deets.

201 (I) and (II). **CORPORATION FINANCE.** Corporate financial behavior; appraisal of factors affecting decision-making regarding sources and application of funds; introduction to capital budgeting and cost of capital problem. Prerequisite, Accounting 125 or permission of instructor. Staff.

201 (I). PROBLEMS IN BUSINESS FINANCE I. Short- and intermediate-term financing; decision-making under uncertainty regarding needs and sources of funds. Prerequisite, Finance 201. Staff.

203 (II). PROBLEMS IN BUSINESS FINANCE II. Long-term financing, capital budgeting, reserves and dividend policy, pensions, company expansion, merger and consolidation, reorganization. Prerequisite, Finance 201. Staff.

204 (I) and (II). MODELS OF FINANCIAL ANALYSIS AND MANAGEMENT. An analytical approach to the study of financial management. Emphasis on theoretical topics of financial decision-making. Through the use of mathematical, statistical and computer simulation methods, various financial decision-making models are made explicit in their assumptions, rigorous in their construction, and testable in their implications. Prerequisite, Finance 201 and the SBA required mathematics and computer courses. Mr. Cheng, Mr. Kumar.

210 (I) and (II). FINANCIAL INSTITUTIONS. The American financial system and functional relationships between financial institutions and economic activities of households, business firms and governmental units. Prerequisites, Econ. 125 and Accounting 125. Mr. Choate. Mr. Ludtke.

220 (I). INVESTMENTS. Development of the general theory of investment with emphasis on the individual investor; practical application of the techniques to real world problems. Mr. Deets.

221 (II). THEORY OF INVESTMENT ANALYSIS. Detailed investigation into contemporary investment strategies; emphasis on the theoretical, with portfolio analysis and random walk being the chief topics. Prerequisite, Finance 220 or permission of instructor.

222 (II). THEORY OF INVESTMENT PROCESSES.

In-depth study of portfolio analysis and stochastic processes in security markets; emphasis on quantitative solution techniques and testing procedures. Prerequisites, Finance 220 and the required SBA quantitative courses. Mr. Deets.

230 (I) and (II). PRINCIPLES OF INSURANCE. Risks encountered by individuals and business firms and methods and institutions which have been established to insure against financial losses. Various forms of insurance are studied primarily from the buyers' point of view. Mr. Osborn.

231 (I). LIFE INSURANCE. Application of life insurance to problems of family security, business security, investments, and estate protection. Mr. Osborn.

232 (I). EMPLOYEE BENEFIT PLANS. Design and administration of pension; profit sharing, group life and health insurance plans and other miscellaneous insured fringe benefit programs. Mr. Osborn.

233 (II). PROPERTY RISKS AND INSURANCE. Methods of protecting against direct and indirect losses from perils of fire, negligence, marine transportation and dishonesty are emphasized. Insurer operational functions of underwriting, claim adjusting, investing and rate making are analyzed. Mr. Osborn.

234 (I). ECONOMIC SECURITY. Public and private programs to prevent or alleviate economic insecurity, including poverty, substandard incomes, and economic contingencies. Also listed as Econ. 341. Mr. Osborn.

GENERAL BUSINESS

240 (I). DOMESTIC TRANSPORTATION SYSTEMS. A comprehensive survey of transport agencies. The differential rates of technological development for each mode and the consequential effects on land utilization, methods of rate making, and the formulation of public policy. Mr. Rivers.

241 (II). LOGISTICS AND THE TRANSPORT FUNCTION. Problems of inventory determination, plant location, trade-offs, transport alternatives, warehousing, etc. in a systems concept. Case and problem approach. Mr. Rivers.

242 (II). PUBLIC SERVICE CORPORATIONS. The organization, operation, and social responsibilities of public utility corporations, and their impact on the economy and the environment. Mr. Rivers.

245 (I). METROPOLITAN TRANSPORTATION. The analysis of economic, social, and technological developments on demand and supply factors for the movement of people and goods within urban areas. Determination of the optimal mix of modal facilities to maximize the total transport resources of the urban area. Coordination of internal and external transport systems. Prerequisite, G.B. 240 or permission of instructor. Mr. Rivers.

GENERAL BUSINESS AND FINANCE

250 (II). ADMINISTRATIVE STATISTICS. Probability and statistical distributions applied to business management problems; application of Bayes' theorem to sampling for business decision-making under uncertainty. Mr. Belovicz, Mr. Whiston.

253 (I). INTRODUCTION TO MANAGEMENT SCIENCE. Introductory but rigorous treatment of optimizing and behavioral models in business management involving the use of elementary techniques in finite mathematics, calculus, statistics, and computer programming. Prerequisite, Comp. Sci. 121, three semesters of college mathematics, including one semester of calculus, and one semester of statistics. (Also listed as Management 253.) Staff.

254 (II). TOPICS IN MANAGEMENT SCIENCE. Deterministic and stochastic models of business management planning and control involving subject matters in efficient allocation of resources, decision theory, organization theory, game theory, non-linear programming, and simulation. Prerequisite, G.B. 253 or equivalent. (Also listed as Management 254.) Staff.

255 (I). DECISION MODELS IN BUSINESS. Introduction to the theory of probabilistic processes in the formulation of decision models and their application to the field of business administration. Staff.

256 (I) and (II). MANAGEMENT SCIENCE APPLICATION AND PRACTICUM. Provides opportunity to apply theoretical models in "real world" situations; current problems in cooperating firms are investigated by students. Staff.

258 (I). QUEUEING THEORY MODELS. Development and application of models of waiting lines, including single and multiple channel and single and multiple stage queues for various priorities and queue disciplines. Prerequisites, G.B. 253 and G.B. 254, or permission of instructor. Staff.

259 (II). TIME SERIES ANALYSIS. The analysis of time series and dynamic models for use in forecasting and control of business and economic systems. Staff.

260 (I) and (II). LAW I. Nature of law and judicial process; the concept of contract; economic functions and consequences of contracts. Law Staff.

261 (I) and (II). LAW II. The nature, functions and limitations of Commercial Law. Prerequisite, G.B. 260. Law Staff.

262 (II). LAW III. The economic functions and consequences of agency, partnerships and corporations. Prerequisite, G.B. 260. Law Staff.

263 (II). LAW IV. Legal problems most commonly encountered by certified public accountants with special attention paid to the subjects currently being included in CPA examinations. (Limited to seniors majoring in accounting). Prerequisite, G.B. 260. (Also listed as Acctg. 263.) Mr. O'Connell.

264 (I) and (II). LAW OF URBAN DEVELOPMENT.

Legal problems generated by the changing urban environment; includes the law of race relations, poverty and welfare, land use and land use planning, urban and regional planning. Prerequisite, G.B. 260 or equivalent. Mr. Bonsignore.

265 (I) and (II). BUSINESS AND ITS ENVIRONMENT.

Theories and doctrines relating the firm to its environment. Aggregate legal, social, political, and economic factors are integrated in a rigorous examination of competing concepts of the role of business in society. Prerequisite, senior class standing or permission of instructor. (Also listed as Management 265.) Mr. d'Errico, Mr. Katsh.

266 (II). LAW I — HONORS.

Nature of law and judicial process; the concept of contract; economic functions and consequences of contracts. Law Staff.

270 (I). REAL ESTATE AND URBAN DEVELOPMENT.

Introduction to principles of urban land use. Economic, legal, social, and political factors that affect real estate markets, valuation and land use.

Mr. Burak, Mr. Plattner.

272 (II). SEMINAR IN URBAN AND REGIONAL STUDIES.

Analysis of the dimensions of urban growth and change; discussion of the reasons behind, and the problems growing out of the economic growth and stagnation of urban areas. Prerequisite, G.B. 270, or Econ. 281, or Econ. 282, or permission of instructor.

Mr. Burak, Mr. Plattner.

273 (I) and (II). INTRODUCTION TO SIMULATION.

The principles and methods of computer simulation. Each student is expected to construct, test, and run a complex simulation model. Also listed as I.E. 273.

Mr. Kaczka.

333. MANAGEMENT INTERNSHIP PROGRAM.

Summer service with a cooperating business firm or governmental agency. The student undertakes responsible duties and participates in managerial activities under supervision of experienced executive personnel. A written report is required. With permission of department chairman.

385 (I), 386 (II). INDEPENDENT STUDY AND RESEARCH.

For qualified seniors, independent study and research on selected problems in Business Administration. With permission of the department chairman.

Credit, 1-3. Staff.

393 (I) and (II). SENIOR HONORS SEMINAR.

Advanced study and research on selected topics in Business Administration and related disciplines. Available only to seniors with 2.8 average or better, and/or by permission of instructor. May be taken both semesters.

399 (I) and (II). SENIOR HONORS.

Professors Bornstein, Carlisle, Chen, Claunch, Elkins, Finch, Frey, Michael, Sahin; Assistant Professors Butterfield, Jones; Lecturer Brooke.

MANAGEMENT

Credits

Required "core" courses

15

Required courses in the major:

12

Management 214, Personnel Management

Management 231, Administrative Theory

Management 247, Production Management I

Management 371, Business Policy and Strategy

Seven courses chosen with the concurrence of the adviser to include, typically, the following:

Curriculum in General Management

Management 265, Business and Its Environment

Management 341, Management Decision Simulation

Management 342, Planning and Control Systems

Management 391, Seminar in Administration

Curriculum in Personnel Management and Industrial Relations

Management 344, Management-Union Relations I

Management 345, Management-Union Relations II

Management 392, Seminar in Personnel Management

Curriculum in Production Management

Management 248, Production Management II

Management 341, Management Decision Simulation

Management 342, Planning and Control Systems

Management 393, Seminar in Operations

Management

Curriculum in Systems Management

Management 341, Management Decision Simulation

Management 342, Planning and Control Systems

Management 393, Seminar in Operations

Management and one of the following:

Accounting 272, Administrative Costing and Control

Industrial Engineering 256, Data Processing and

Information Handling Systems

Economics 301, Decision Theory

Statistics 271, Sampling Theory and Methods

Curriculum in Business Administration and Quantitative Methods

Freshman Mathematics Requirements:

Desirable but not required that persons considering this major elect the Mathematics 123, 124 sequence in place of Mathematics 116, 117.

Credits

Required "core" courses

15

Required courses in the major:

12

General Business 250, Administrative Statistics

Management 253, Introduction to Management

Science

Management 254, Topics in Management Science

General Business 256, Management Science

Application and Practicum

Specialization Electives:

21

12 credit hours from a list of quantitative electives

9 additional credit hours in Business Administration and Economics

Electives outside of Business Administration and area of specialization

12

Management

Chairman of Department: Professor George B. Simmons. Professors Conlon, Hare, Litterer, McGarrah, O'Donnell, Wortman, Young; Associate

110 (I) and (II). INTRODUCTION TO COMPUTERS FOR BUSINESS.

The BASIC and FORTRAN computer programming languages; use of the computer for business data processing and problem solving. (Also listed as Accounting 110.)

201 (I) and (II). PRINCIPLES OF MANAGEMENT.

Fundamental principles and practices of the managerial process in business enterprises.

210 (I) and (II). BUSINESS APPLICATIONS OF COMPUTERS.

Intermediate and advanced computer programming with emphasis on problems in accounting and management information systems. Prerequisites, Accounting 125 and 126, and Management 110. (Also listed as Accounting 210.)

211 (II). BUSINESS INFORMATION SYSTEMS.

Data processing methods and techniques as they relate to business information systems with emphasis on the role of the accountant and manager in the design and operation of the systems. Complementary methods of providing information to management for purposes of control, planning, and decision-making. Prerequisites, Accounting 126 and Management 251 or equivalent. (Also listed as Accounting 211.)

214 (I) and (II). PERSONNEL MANAGEMENT.

Principle and policies followed by management in recruitment, development, direction, and control of personnel.

231 (II). ADMINISTRATIVE THEORY.

Principles of administration, modern organization theories, specialization, functionalization, coordination, planning and control, authority status, leadership, decision-making, communication, and power-structuring. Prerequisite, Management 201.

234 (II). WAGE AND SALARY ADMINISTRATION.

Objectives, procedures, and problems involved in establishment and administration of operative and executive compensation plans. Prerequisite, Management 214.

247 (II). PRODUCTION MANAGEMENT I.

Basic principles of production management. Use of statistical, mathematical, and simulation methods in production or operations. Prerequisite, Management 201.

248 (I). PRODUCTION MANAGEMENT II.

Application of principles and analytical techniques to design and operation of production systems. Quality control, inventory and production control. Prerequisite, Management 247.

253 (I). INTRODUCTION TO MANAGEMENT SCIENCE.

Introductory but rigorous treatment of optimizing and behavioral models in business management involving the use of elementary techniques in finite mathematics, calculus, statistics, and computer programming. Prerequisites, Comp. Sci. 121, and three semesters of college mathematics, including one semester of calculus, and one semester of statistics. (Also listed as G.B. 253.)

254 (II). TOPICS IN MANAGEMENT SCIENCE.

Deterministic and stochastic models of business management planning and control involving efficient allocation of resources, decision theory, organization theory, game theory, non-linear programming, and simulation. Prerequisite, Management 253 or equivalent. (Also listed as G.B. 254.)

265 (I) and (II). BUSINESS AND ITS ENVIRONMENT.

Theories and doctrines relating the firm to its environment. Aggregate social, political, legal and economic factors integrated in a rigorous examination of competing concepts of the role of business in society. Prerequisite, senior standing or permission of instructor. (Also listed as G.B. 265.)

333. MANAGEMENT INTERNSHIP PROGRAM.

Summer service with a cooperating business firm or governmental agency. The student undertakes responsible duties and participates in managerial activities under supervision of experienced executive personnel. A written report is required. With permission of department chairman.

341 (I). MANAGEMENT DECISION SIMULATION.

Participation in management of a firm in a simulated industry. Students, organized into management teams, apply their knowledge of business administration and economics in a competitive struggle for profit and market position. Prerequisite, senior standing and permission of instructor.

342 (II). PLANNING AND CONTROL SYSTEMS.

Systems coordinating sales, production, finance and other business functions and producing information required for adjustment and reformulation of plans over time. Both single-use and continuous-use plans. Design of organization structure and development of control criteria. Prerequisite, senior standing.

344 (I). MANAGEMENT-UNION RELATIONS I.

Comparison of union-management objectives, functions, and structures, including scope and impact of union penetration into areas of managerial authority. Prerequisite, Management 201 or 214.

345 (II). MANAGEMENT-UNION RELATIONS II.

Problems in interpretation and administration of collective bargaining agreements, studied by the case method of analysis. Prerequisite, Management 344 or permission of instructor.

371 (II). BUSINESS POLICY AND STRATEGY.

An integrating course embracing all organic management functions. Cases are used as subjects for analysis and systematic decision-making practice. Prerequisites, Management 201 and senior standing.

385, 386. SPECIAL PROBLEMS.

Individual study of a selected problem for qualified students. By arrangement with members of the department.
Credit, 1-3.

391 (I). SEMINAR IN ADMINISTRATION.
Advanced study and individual research in theory and practice of administrative organization and behavior. Prerequisite, senior standing and permission of instructor.

392 (II). SEMINAR IN PERSONNEL MANAGEMENT.

Advanced study of current problems in development and administration of personnel problems. Research methodology and recent research findings emphasized. Each student required to complete a major research project. Prerequisite, senior standing and permission of instructor.

393 (I) and (II). SENIOR HONORS SEMINAR.
Advanced study and research on selected topics in Business Administration and related disciplines. Available only to seniors with 2.8 average or better, and/or by permission of instructor. May be taken both semesters.

394 (II). SEMINAR IN OPERATIONS MANAGEMENT.

Specialized topics and advanced techniques in production and operations management. Prerequisite, Management 247.

Marketing

Head of Department: Professor Jack S. Wolf. Professor Smith; Associate Professors Buell, Frederick, Johnson, Monroe, Paul, Schwartz, Venkatesan, Worthing; Assistant Professors Barber, Guiltinan, Wiek; Lecturer Liander.

<i>Curriculum in Marketing</i>	<i>Credits</i>
Required "core" courses	15
Required course in the major:	
Marketing 216, Marketing Management	3
Functional Courses (any <i>two</i> of the following):	6
Marketing 221, Product Planning and Development	
Marketing 222, Marketing Communications	
Marketing 223, Marketing Network Analysis	
Marketing 224, Analysis for Pricing Decisions	
Tool Courses (any <i>two</i> of the following):	6
Marketing 210, Buyer Behavior	
Marketing 212, Marketing Research	
Marketing 214, Marketing Models	
Expansive Courses (any <i>one</i> of the following):	3
Marketing 213, Advanced Marketing Research	
Marketing 219, Marketing Strategy	
Marketing 237, International Marketing	
Marketing 390, Seminar in Marketing Research	
Marketing 385, -6, Independent Study and Research	
Marketing 399, Honors	
One Advanced Behavioral Science Elective	3
One Advanced Economics Elective	3
Total Program Credits	39
Free Elective Credits	21

201 (I) and (II). FUNDAMENTALS OF MARKETING.

The role of marketing in our economic and social structure. The planning, distribution, pricing and promotion of goods and services to consumer and industrial markets, viewed as internal activities of the firm, and as shaped by environmental forces. Prerequisite, Econ. 125 or permission of instructor. Mrs. Barber, Mr. Wiek.

210 (I) and (II). BUYER BEHAVIOR.

Analysis of buyer motivation and buying behavior. Explanatory theories of consumer market behavior and models of the decision-making process for winning patronage. Prerequisite, Marketing 201 or permission of instructor. Mr. Paul, Mr. Schwartz, Mr. Venkatesan.

212 (I) and (II). MARKETING RESEARCH.

The systematic gathering, recording and analyzing of data about problems relating to the marketing of goods and services. Individual case study and research projects. Prerequisites, Marketing 201 and Statistics 121 or 315, or permission of instructor.

Mr. Frederick, Mr. Guiltinan, Mr. Monroe.

213 (II). ADVANCED MARKETING RESEARCH. Select areas of marketing research. Emphasis on non-survey research techniques. Substantive problems of experimental research and research design and analysis. Class problems consist of laboratory or field experiments. Prerequisite, Marketing 212, or permission of instructor.

Mr. Venkatesan.

214 (I) and (II). MARKETING MODELS.

Relates a number of concepts and techniques to the analysis and solution of marketing management problems. Mathematical models as aids to decision-making in marketing. Prerequisite, Marketing 201 or permission of instructor.

Mr. Frederick, Mr. Monroe.

216 (I) and (II). MARKETING MANAGEMENT.

An advanced understanding of the nature and problems of marketing management: the process of marketing management, the environments facing the marketing manager, and the tools available for environmental analysis and control of marketing activities. Prerequisite, Marketing 201 or permission of instructor.

Mr. Buell, Mr. Paul, Mr. Worthing.

219 (I) and (II). MARKETING STRATEGY.

Exposure to realistic problems through computerized simulation and analysis of cases. Practice in seeking solutions to marketing problems through an integration of factors pertinent to strategy development. Prerequisite, Marketing 216 or permission of instructor.

Mr. Wolf.

221 (I) and (II). PRODUCT PLANNING AND DEVELOPMENT.

Examination and analysis of the factors pertinent to effective product decisions by marketing managers. The organization of the product planning function, matching products and markets, and methods for reducing new product risk. Prerequisite, Marketing 201 or permission of instructor.

Mr. Worthing.

222 (I) and (II). MARKETING COMMUNICATIONS.

Development of effective marketing communication strategies based upon an understanding of the characteristics of audiences. Conceptual material from communications theory. Prerequisite, Marketing 201 or permission of instructor.

Mr. Wiek.

223 (I) and (II). **MARKETING NETWORK ANALYSIS.**

A systems approach to the management of all activities that facilitate the movement of goods and coordination of supply and demand. Problems of designing and managing product distribution network. Prerequisite, Marketing 201 or permission of instructor.

Mr. Guiltinan, Mr. Wiek.

224 (II). **ANALYSIS FOR PRICING DECISIONS.**

The relationship of pricing objectives, methods, and policies to market behavior and the goals of the firm. Pricing models and contributions of behavioral sciences to pricing analysis. Prerequisite, Marketing 201 or permission of instructor.

Mr. Monroe.

237 (I). **INTERNATIONAL MARKETING.**

Background useful to United States business enterprises which market goods and services in foreign countries. Emphasis on the firm's marketing operations and the design of marketing strategy. Prerequisite, Marketing 201 or permission of instructor.

Mr. Liander.

385, 386. **SPECIAL PROBLEMS.**

Individual study of a selected problem for qualified stu-

dents. By arrangement with members of the department. *Credit, 1-3.*

390 (II). **SEMINAR IN MARKETING.**

Advanced study and individual research on selected problems and current issues in marketing. Each student is required to complete a major research project. Prerequisites, senior standing and permission of instructor.

Staff.

393 (I) and (II). **SENIOR HONORS SEMINAR.**

Advanced study and research on selected topics in business administration and related disciplines. Available only to seniors with 2.8 average or better, and/or by permission of instructor. May be taken both semesters.

RELATED COURSES

Accounting 272, Administrative Costing and Control.

General Business 241, Management of Traffic and Physical Distribution

General Business 250, Administrative Statistics

General Business 253, Introduction to Management Science

Management 265, Business and Its Environment

Management 342, Planning and Control Systems

School of Education

DWIGHT ALLEN, *Dean*

Earl Seidman, *Associate Dean*

Norma Jean Anderson, *Assistant Dean*

Atron Gentry, *Assistant Dean*

Bob H. Suzuki, *Assistant Dean*

Professors Alschuler, Anthony, Carew, Ertel, Fischer, Fortune, Ivey, Jordan, Kesselheim, Kornegay, Reed, Simon, Ulin, Weinstein, Wolf, Wyman; Associate Professors Anderson, Blanchard, Cappeluzzo, Coffing, Day, Eve, Fredrickson, French, Griffiths, Hutchinson, Jones, Joseph, Konicek, Lauroesch, McCoy, Schimmel, Sullivan, Rudman, Thelen, Tutman, Washington, Wellman, Woodbury; Assistant Professors Abraham, L. Blane, S. Blane, Budde, Bunker, Carmody, F. Clark, R. Clark, Conway, DeTurk, Eddy, Eiseman, Evans, Fanslow, Flight, Forsyth, Glenn, Gorth, Haase, Hall, Hambleton, Hawkes, Hruska, Jones, Keochakian, R. Kraus, W. Kraus, LaFrance, Lieberman, Masalski, Miltz, Peck, Preston, Rossman, Rudman, Sinclair, Urch, Wagschal, Wideman, Wiggins, Wuerthner, Yarington; Lecturers Andres, Ball, Brainerd, Caban, Christensen, Cook, Damerell, Dede, Dodge, Dye, Gat, Gates, George, Greenebaum, Ivey, Love, Mackin, Parisi, Rutstein, Swaminathan, Williams, Wilson.

The School of Education has revised its entire curriculum with the intent of providing students with a variety of alternatives, relying more heavily

on self-directed learning and focusing on problems and areas which have a high degree of social relevance. This revision and reevaluation of curriculum and structure is an on-going process which will result in many new programs not included in the following information.

There are presently thirteen learning centers within the School, each dealing with specific areas of education: Aesthetics in Education; Foundations of Education; Higher Education; Human Potential; Human Relations; Humanistic Education; International Education; Educational Innovations; Leadership in Educational Administration; Media in Education; Educational Research; Teacher Education; Urban Education; and one center not related to a specific area of education: Non-Center. In addition to the above centers the school lists the following programs: Occupational Education, Reading Program and the Program for the Study of the Future in Education. All centers offer courses which are open to undergraduates, regardless of major, for their own professional and personal development.

Most undergraduate majors are involved with preparation for a career in teaching. There is a great need for highly skilled, competent and expert teachers in our society; at the same time, the profession has become highly competitive due to a decrease in employment opportunities. Accordingly, the School of Education is planning to con-

centrate more on the quality of teacher training than its quantitative aspects.

Students interested in education as a career are instructed to arrange an appointment with the Advisers' Office in the School to ascertain what requirements the student needs to complete and what alternatives are open to fulfill these requirements. This should be done as early as possible to avoid later disappointments. The Advisers' Office for undergraduates is in Room 121 in the School of Education, telephone 545-1543.

A non-teaching major is available through several centers. The student must be accepted into the School by the Center Director and the Assistant Dean for Student Affairs, and will develop his academic program with a faculty adviser. Media, education of the deaf, and educational research are examples of non-teaching major programs available.

MODULAR CREDIT PROGRAM

Another integral part of the undergraduate program is the Modular Credit Program. This exciting spin-off from traditional education enables students and faculty alike to share in varied learning experiences. Each learning experience carries an agreed-upon number of modules of credit, which are cumulative. Fifteen modules are equivalent to one University credit. Independent study programs are also offered to undergraduates. The student negotiates a learning contract with a sponsoring faculty member and is enabled to pursue in-depth study in an area of education, fusing personal and social relevance into his program of study.

Students should realize that the outline programs are minimum requirements in the subject field. Since our policy is to give the student a high degree of freedom and alternatives to choose courses with respect to his individual and professional interests, there is a great deal of flexibility within all undergraduate programs. Undergraduates should also be aware that all grading in the School of Education is done on a pass-fail basis.

For further information, all interested students are invited to contact the Undergraduate Affairs Office, Room 121 in the School of Education, telephone 545-1543.

TEACHER PREPARATION PROGRAMS COUNCIL

The Teacher Preparation Programs Council (TPPC) is an inter-center council made up of nine members (six faculty, two undergraduates, one graduate student) which is responsible for undergraduate and graduate teacher preparation programs. The Council's major focus is on creating new options and alternative routes for meeting undergraduate degree and certification requirements. It is also responsible for coordinating the

undergraduate education programs of the School and evaluating undergraduate offerings. Formed in February of 1971, the Council presently has available 16 different programs, focusing on areas such as urban education, the "integrated day", international education, and early childhood. There is a strong emphasis on off-campus internships in the TPPC programs, which vary in length from one to three years. Additionally, any student who does not choose one of the 16 programs has the opportunity to choose an individualized program in consultation with the Student Affairs Office and TPPC. More specific information on TPPC sponsored programs may be obtained from the undergraduate advisers in the TPPC Administrative Offices in Room 121, or by contacting the individual TPPC program directors.

Description of Learning Centers

1) CENTER FOR AESTHETICS IN EDUCATION

The basic objective of the Center is to reconceptualize the role of the arts in education and the aesthetic experiences they can mediate within the public school system at all levels. This process of reconceptualization involves: a) The development of a philosophy of "applied aesthetics" which may function as an extensive set of assumptions on which the work of the Center may be imaginatively and creatively pursued; b) The innovation of curricula appropriate to all art and experimental media; c) The training of teachers and/or administrators in the function, purpose, and means of applying and utilizing these curricula; d) Undertaking research and evaluation activities relative to the curricula developed and the teacher training program designed to go with them; and e) Developing a resource center in aesthetics in education which will also serve a dissemination function.

2) CENTER FOR FOUNDATIONS OF EDUCATION

The Center for Foundations of Education serves several functions in the School of Education. In the preparation of teachers, the study of the history, philosophy and sociology of education provides undergraduate students with a substantial background of interpretative knowledge about the processes and institutions of education. Study within the Center can provide a longer time perspective to the prospective teacher and can bring information to bear upon educational problems that sets them in their proper contexts.

In service to the entire School of Education, persons in the Center are equipped to analyze educational problems, ideas and ideologies from disciplinary points of view usually not represented in other areas of the School.

3) CENTER FOR HIGHER EDUCATION

The primary focus of the Higher Education Program is the preparation of instructional leaders and administrators for both two- and four-year institutions of higher training. Courses and experiences offered by the program include a human relations core with emphasis on curriculum and faculty development and alternative organizational structures. Topics include the individual and his alienation from society, the institutions of higher education — their structure (e.g., alternative structures, organizational analyses), their influence on individuals (students' rights, governance, etc.), and ways of working within them (experimental innovations such as residential studies, living-learning experiments, alternative reward systems, and curriculum alternatives). Emphasized in all courses are current pertinent literature and developments in American higher education.

4) CENTER FOR THE STUDY OF HUMAN POTENTIAL

The primary purpose of the Center is the development of an understanding of the nature of human potential and the facilitation or inhibition of its release by the education process which is employed.

The premise underlying the work of the Center is that since culture shapes attitudes and feelings about self which produce motivational and volitional strengths or inadequacies, education, when properly conceived, will refer to those experiences and processes which will facilitate the release of human potential at an optimum rate.

Attitudes of racism have much to do with the formulation of opinions about self, particularly in young children. Since these attitudes generate opinions which are inhibitive factors in the development and release of human potential, an integral part of all of the programs and activities within the Center will be the dissolution of all attitudes of racism.

The key factor in the release of human potential is learning competence. Consequently, the major thrust of the Center's efforts concerns development of a basic educational model which focuses on the development of learning competence and which differs significantly from traditional models whose primary focus is on information storage and retrieval.

A variety of programs, projects, courses and modular offerings are provided by the Center. Special interests of the Center include early childhood education, the role of education in juvenile delinquency prevention, educational models for correctional settings, education for culturally pluralistic populations, and the development of an educational model which concentrates on strengthening learning competence.

5) THE HUMAN RELATIONS CENTER

The Human Relations Center is concerned with the enhancement of the personal development and functioning of students at all stages of their education and in all their human relationships. The Center proceeds from the assumption that there is a powerful interrelationship between the functioning of the individual and the groups in which he lives and works. Thus, the Human Relations Center takes as its concern the facilitation of the growth and development of the individual, of the small group, and of the organization or community. On the undergraduate level, the Center sponsors a Human Relations Resource Center which offers modules, experiences and workshops which foster the growth and development of participants and the groups with which they are connected.

6) CENTER FOR HUMANISTIC EDUCATION

Humanistic Education is a new curriculum area with its own teaching methodology. We feel that it is both necessary and possible to develop such a program of instruction to promote and deal directly with the concerns, needs and personal reactions of the student. Thus, the student's repertoire of behaviors for negotiating with himself, with others and with social institutions constitutes the content of a program in Humanistic Education. Humanistic Education gives almost total attention to the learner, for he is — in fact — the subject matter of the program. His concerns about his own identity, his sense of affiliation, and his concern for his own personal power will structure the type of curriculum he will experience.

7) CENTER FOR INTERNATIONAL EDUCATION

"International Education" is the institutionalized process of mobilizing and building human resources for active participation in a world-centered system of education and human development.

The programs, courses and experiences offered by the Center are designed to: a) help foster the knowledge and understanding of students regarding subcultures of our nation and cultures of the world; b) help prepare them for leadership roles in the international affairs of our nation; and c) prepare them to work with the socioeconomic and political development of other nations via the medium of education. Students who enter programs offered by the Center may prepare to teach at any educational level at home and abroad or for nonteaching roles in the field of international education.

8) CENTER FOR THE STUDY OF EDUCATIONAL INNOVATIONS

This Center was created to inquire systematically into processes of educational change and to bring

about school improvement. To this end, CSEI developed three interdependent action units, which are: a) Working on creating and improving educational practices; b) Retrieving data, evaluating and conducting research on current and experimental practices, as well as on strategies for bringing about change; c) Developing ways for schools in Massachusetts and elsewhere to take advantage of the available knowledge about innovations.

Because it is involved in the above activities, the Center can provide training for students in various phases of proposal development, conference and workshop planning, innovation conceptualization and development, research and evaluation, administration, teaching and consultation. The amount of credit earned will vary, depending on the intensity and the quality of the supervised experience.

9) CENTER FOR LEADERSHIP IN EDUCATIONAL ADMINISTRATION

The leader-administrator exerts his influence on his associates whether in schools, colleges, universities, unions or other agencies. Students are provided courses and experiences relevant to the development of leader-administrator skills and also are advised how and where they may find courses and experiences available elsewhere. Teaching, practicum, and internship experiences are drawn from the public schools, the non-public schools, and the Five-College consortium.

10) CENTER FOR EDUCATIONAL RESEARCH

The Center for Educational Research maintains the belief that the empirical study of educational processes is the single most important method for the advancement of education, both in terms of developing new knowledge and in terms of providing systematic information and analyses of current practices. The Center not only seeks to serve research needs within the community, but also to recruit and train, for all levels, educational personnel interested in applying behavioral science methods to relevant educational problems capable of furthering knowledge about behavioral science processes.

The primary function of the Center is to provide an intellectual environment conducive to quality educational research. This environment includes pursuit of research and scholarship both in the field and at the University through a differentiated team approach.

11) MEDIA IN EDUCATION

The Center for Communication in Education is expanding and developing its commitment to sensitive and dynamic communication. Its two primary interrelated components — the anatomy of interpersonal, intra-organizational, and mass communi-

cations, and media production and technical systems — together focus upon providing the essential training and experiences necessary for meaningful and relevant communication of our complex "World Culture." Courses are offered in television, film, video tape, and other audio-visual production, and use of these media to further educational processes and purposes. The courses range from "hands on" experience operating equipment to the theoretical uses of media in relation to learning; the development of communicative graphics; and the effective communication verbal and non-verbal from person-to-person to mass audiences via broadcast media. All students are encouraged not only to develop an appreciation of the economics of educational projects and programs, but also to participate in the fund raising and administration of programs, which are integral aspects of any institution.

12) CENTER FOR TEACHER EDUCATORS

The Center for Teacher Educators is intended for students interested in fields such as pre-service teacher preparation, inservice programs, supervision, state and national departments of education, research in teacher education, and development of teacher education programs. The Center assumes that the educational experiences potentially relevant to such fields are general and highly diverse. Each student entering the Center is responsible for choosing the specific learnings he wishes to pursue. The curriculum is developed by each student, in cooperation with his advisers and peers, to meet his own needs, developing interests, and long-range plans. While there may be common elements of content and skills that many students will wish to explore together, the Center makes no *a priori* content requirements, either in the form of courses or of modules. Students are encouraged to develop thorough competencies in at least one major phase or feature of teacher education.

13) CENTER FOR URBAN EDUCATION

The Center for Urban Education (CUE) is a planning, research, and training center focusing on education in urban areas. CUE takes as a starting point the role of racism in creating and perpetuating unequal educational opportunity and results for poor and minority Americans. The Center sees the following as its task: a) to develop new strategies for urban schools that will bring real changes in teacher attitudes, curriculum and school structures; b) to develop tools for community involvement to help bring about these changes. In order to accomplish the foregoing tasks, CUE operates on two levels: 1) on-campus courses and programs, and 2) off-campus programs. Undergraduates par-

ticipate in the Teacher Education Program which combines course work with an urban teaching and living experience.

THE NON-CENTER

The Non-Center exists to represent those students and faculty who wish to have maximum flexibility to utilize the resources of the School of Education without being formally affiliated with any of the centers which have a specific content focus. Some students and faculty affiliate with the Non-Center because they wish to work on projects or programs which necessitate utilizing the resources of many different centers simultaneously. Others seek out the Non-Center because they have an interest, such as computers or the study of the future, which does not properly fit in any existing center but may grow and soon emerge as a new program or center within the School of Education. At its best, the Non-Center is a collection of individuals, engaged in diverse activities, who believe in an holistic approach to the study of education.

OCCUPATIONAL EDUCATION PROGRAM

The staff of the Occupational Education Program believes that the social, educational, and occupational problems of the future require that individuals in leadership positions in occupational education not limit their function to vocational and technical education, but be concerned with every aspect of education. Given the assumption that the survival of mankind may depend on the ability of educators to provide effective growth experiences for children and adults, the Occupational Education Program is committed to a rigorous evaluation of existing occupational programs and a continuous search for content and methodology that can contribute to more effective occupational preparation. This commitment to an ongoing evaluation and search effort implies a cross-center approach which addresses itself to questions of learning theory, goals of education, economics, national needs, and systems analysis, and dictates that close coordination be established with all the resources of the University and other Centers of the School of Education, particularly the Urban Education Cen-

ter, the Human Relations Center, the Leadership and Administration Center, Educational Foundations Center and the Research Center.

READING PROGRAM

The Reading Program presents several alternatives to prospective and practicing teachers for the teaching of beginning and developmental reading. The program in developmental reading. Above all, the instructional and organizational routes for helping children to master this process, and questions many of the traditional practices and materials, continually experimenting with alternatives. The staff hopes to eventually eliminate the necessity for remedial reading by providing, and teaching teachers to provide, a strong individually-oriented program in developmental reading. Above all, the program aims to convey and perpetuate an open attitude toward change, a willingness to try many routes to achieve a goal, and the understanding that there is no one right way of doing anything but rather that the approach must be suited to the time, the need, and the individual.

PROGRAM FOR THE STUDY OF THE FUTURE IN EDUCATION

The Program for the Study of the Future in Education is a relatively new program dedicated to the idea that we must educate people now for the future. We are attempting to develop and refine tools to help teachers on all levels orient their work toward the future and materials that can be used by school districts for medium- and long-range policy planning. Two of our primary commitments are that teaching for the future does not require special resources or expertise and that any subject matter can be taught in a future-oriented manner. We are also working toward developing future alternatives to the present formal educational system and extending the theoretical and practical capabilities of future studies as a discipline. We are offering a number of courses during the spring 1972 semester aimed at fulfilling the above goals, including one for undergraduates that will introduce both future studies as a discipline and future-oriented teaching materials.

School of Engineering

Lester C. Van Atta, *Associate Dean*

Joseph S. Marcus, *Associate Dean*

Roscoe F. Ward, *Assistant Dean*

The School of Engineering has the following recommended program of common courses for the Freshman year.

<i>1st Semester</i>	<i>Credits</i>
Rhetoric 100	3
Mathematics 123	3
Chemistry 111	3
Engineering 103 or 104	3
Social Science Elective	3
Physical Education	1
	16

<i>2nd Semester</i>	
Humanities Elective	3
Mathematics 124	3
Chemistry 112	3
Engineering 103 or 104	2 or 3
Physics 161	4
Physical Education	1
	16 or 17

100. INTRODUCTION TO ENGINEERING AND TECHNOLOGY (E).

Engineering and technology as the management and processing of energy, material, and information. Major engineering concepts such as the system, feedback, and optimization. The methods of engineering including analysis, design synthesis, and decision making. Case studies and student projects. Not open to engineering majors.

103. INTRODUCTION TO ENGINEERING A.

The nature of engineering practice, through lectures and problem work. Some generally useful concepts to be developed in more detail in later courses. Three 2-hour lecture, problem or laboratory periods per week.

Credit, 2-3.

104. INTRODUCTION TO ENGINEERING B.

Continuation of Engineering 103. Three 2-hour lecture, problem or laboratory periods per week. *Credit, 2-3*

251. NUMERICAL METHODS IN ENGINEERING.

A computer oriented course introducing application and theory of numerical interpolation, solutions of transcendental equations, quadrature, solution of simultaneous linear equations, solutions of ordinary differential equations, and solving some simple boundary value problems. Prerequisites, Math. 174 or equivalent and an elementary FORTRAN or APL course.

385, 386. SPECIAL PROBLEMS.

Individual study of a selected problem for qualified students. By arrangement with members of the department.

Credit, 1-3.

Chemical Engineering

Head of Department: Professor John W. Eldridge. Professors Cashin, Douglas, Lenz, Lindsey, Middleman, Roblee, Vanpee; Associate Professors Kirk, Kittrell, Laurence, McAvoy, Short; Assistant Professor Novak; Adjunct Associate Professor Chappellear.

SOPHOMORE YEAR

<i>1st Semester</i>	<i>Credits</i>
Ch.E. 125, Fundamentals	3
Chem. 160, Organic	3
Physics 162, General Physics II	4
Math. 173, Analytic Geometry and Calculus III	9
Elective	3
Ch.E. 101, Chemical Engineering Practice I	1
	17

<i>2nd Semester</i>	
Ch.E. 126, Chemical Engineering Thermodynamics	3
Ch.E. 258, Organic Chemical Technology	3
Physics 163, General Physics III	4
Math. 187, Differential Equations for Engineers	3
Elective	3
Ch.E. 102, Chemical Engineering Practice II	1
	17

JUNIOR YEAR

<i>1st Semester</i>	<i>Credits</i>
Ch.E. 255, Chemical Engineering Fluid Mechanics	3
Ch.E. 374, Simulation	3
Chem. 285, Physical Chemistry	3
Math. 174, Analytic Geometry and Calculus IV	3
Elective	3
Ch.E. 201, Chemical Engineering Practice III	1
	16

<i>2nd Semester</i>	
Ch.E. 256, Chemical Engineering Heat Transfer	3
Ch.E. 257, Mass Transfer	3
Chem. 286, Physical Chemistry	3
Chem. 288, Physical Chemistry Laboratory	2
Engl. 331, Technical Writing	2
Elective	3
Ch.E. 202, Chemical Engineering Practice IV	1
	17

SENIOR YEAR

<i>1st Semester</i>	<i>Credits</i>
Ch.E. 358, Staged Operations	4
Ch.E. 380, Kinetics and Reactor Design	4
Ch.E. 383, Process Evaluation	3
Elective	3
Ch.E. 301, Chemical Engineering Practice V	1
	15

<i>2nd Semester</i>	
Ch.E. 376, Process Control and Dynamics	3
Ch.E. 384, Process and Plant Design	3
Ch.E. 392, Seminar	2
Chem. 219, Electronics Instrumentation	3
Electives	4-6
Ch.E. 302, Chemical Engineering Practice VI	1
	16-18

Note: The electives must include, to satisfy University core requirements, at least three 3-credit humanities courses plus at least three 3-credit courses in the social sciences. Note that any ROTC study must be in addition to the normal load.

101, 102, 201, 202, 301, 302. CHEMICAL ENGINEERING PRACTICE I-VI.

By means of laboratory investigations, classroom demonstrations, films, plant trips and invited speakers, theoretical lecture material is related to industrial practice. Each practice course is closely coordinated with lecture material the student is taking concurrently and emphasizes the application of basic concepts in the solution of industrial problems. Corequisite, the concurrent Ch.E. courses for that semester of the curriculum, or permission of the instructor. 3-hour laboratory period or 1-hour demonstration or lecture.

Credit, 1 each semester of the Sophomore, Junior and Senior years.

125 (I). FUNDAMENTALS.

Nature and scope of chemical engineering through study of selected chemical processes and of material and energy balances. Prerequisite, Chem. 112 or 114.

126 (II). CHEMICAL ENGINEERING THERMODYNAMICS.

The fundamental principles of thermodynamics. An in-depth discussion of the First and Second laws; study of properties of single-component systems, thermodynamic cycles, phase and chemical equilibria. Solution methods for complex energy and material balance problems are introduced. Prerequisites, Chem. 160, Math. 173, Ch.E. 125.

255 (I). CHEMICAL ENGINEERING FLUID MECHANICS.

An introduction to momentum transport in fluids including the development of the Navier-Stokes equations and boundary layer analysis. Emphasis on the application of the theory to laminar and turbulent flow in chemical process equipment such as: flow meters, pipes, pumps, packed beds, filtration equipment, sedimentation, and classification units, etc. Prerequisites, Ch.E. 126, Math. 187.

256 (II). CHEMICAL ENGINEERING HEAT TRANSFER.

Theory of heat transfer by conduction, convection, and radiation with applications to the Unit Operations of Chemical Engineering. Prerequisite, Ch.E. 255.

257 (II). MASS TRANSFER.

Theory and application of diffusional phenomena. Microscopic and macroscopic problems of mass transfer, diffusion in a boundary layer, diffusion and chemical reaction, interphase transfer. The continuous contactor provides the framework in which are reviewed absorption, extraction, chromatographic separators and simultaneous heat and mass transfer. Prerequisite, Ch.E. 255.

258 (II). ORGANIC CHEMICAL TECHNOLOGY.

Applications of the principles of structure and reaction mechanisms of organic chemistry in the preparation and use of industrially-important organic chemicals and polymers. Prerequisite, Chem. 160 or permission of instructor.

CHEMICAL ENGINEERING

358 (I). STAGED OPERATIONS.

An introduction to the design of equilibrium stage processes. Topics include the thermodynamics of phase equilibria, binary and multicomponent distillation, absorption, extraction, leaching and azeotropic phenomena. Prerequisites, Ch.E. 126, Ch.E. 256 and 257. 3 class hours, 1 2-hour computation period. *Credit, 4.*

360. AIR POLLUTION CONTROL PROCESSES.

An introduction to the techniques of air pollution control particulate removal, wet and dry scrubbing processes, removal of selected species from gases (e.g., sulfur dioxide). Prerequisites, freshman chemistry, permission of instructor. 2 class hours. *Credit, 2.*

361 (I). CHEMICAL ENGINEERING ANALYSIS I.

Mathematical techniques applied to chemical engineering problems. Emphasis on ordinary differential equations corresponding to specific problems and on their solution. Prerequisites, Ch.E. 256 and 257.

362 (II). CHEMICAL ENGINEERING ANALYSIS II.

Mathematical analysis of chemical engineering problems continued. Topics include: matrix methods, vector analysis, calculus of finite differences, numerical solution of ordinary and partial differential equations, complex variables and Laplace transformations. Emphasis on applying these techniques to real chemical engineering processes and on the physical and mathematical interpretation of the results. Prerequisite, Ch.E. 361.

363 (I). SURVEY OF NUCLEAR ENGINEERING I.

Principles of reactor physics and problems involved in design and operation of nuclear reactors; heat transfer, shielding, instrumentation and waste disposal. Prerequisites, Chem. 112 or 114; Physics 142 or 162; Math. 186, or equivalent, and permission of instructor. 2 class hours, 1 3-hour laboratory period.

364 (II). SURVEY OF NUCLEAR ENGINEERING II.

Continuation of Course 363; emphasis on reactor physics. Prerequisite, Ch.E. 363. 2 class hours, 1 3-hour laboratory period.

370. APPLIED POLYMER SCIENCE.

A survey of the methods of preparing important synthetic polymers, and their properties and applications. Prerequisite, undergraduate organic and physical chemistry.

374 (I). SIMULATION.

Simulation of physical processes using both analog and digital techniques. Topics include: programming of analog computers (linear and non-linear components, scaling, iterative operation), solutions of linear and non-linear differential equations, simulation languages, useful numerical techniques (Runge-Kutta, relaxation). Prerequisite, Math. 187. 2 class hours, 1 3-hour laboratory period.

376 (II). PROCESS CONTROL AND DYNAMICS.

Theoretical and practical factors governing automatic control of industrial processes; control systems, review of measurement devices, control modes, mathematical

relationships and analysis of control systems. Prerequisites, Ch.E. 374, Math. 187. 2 class hours, 1 3-hour laboratory period.

380 (I). KINETICS AND REACTOR DESIGN. Principles underlying rates of transformations of matter and energy. Review of pertinent differential equations; effect of temperature and catalysis on chemical reaction rates; application to design of chemical reactors. Prerequisites, Ch.E. 126, Chem. 286. 3 class hours, 1 2-hour computation period. *Credit, 4.*

383 (I). PROCESS EVALUATION. Solution of problems which require the use and integration of principles studied in previous courses. Final results will be determined by application of economic considerations. Prerequisites, Ch.E. 256, 257; Chem. 286. 2 class hours, 1 3-hour computation period.

384 (II). PROCESS AND PLANT DESIGN. Optimum design of selected chemical plants; production rates, site location, process flow diagrams, equipment design and sizing, total costs, etc. Prerequisite, Ch.E. 383. 2 class hours, 1 3-hour computation period.

385, 386. SPECIAL PROBLEMS. Individual study of a selected problem for qualified students. By arrangement with members of the department. *Credit, 1-3.*

388 (I). OPTIMIZATION. Fundamental ideas and application of optimization techniques in operation and design. Topics include: extrema of functions, effect of constraints. LaGrange multipliers, introduction to linear programming, geometric programming and dynamic programming. Prerequisite, Math. 187.

389. (II). OPTIMIZATION USING VARIATIONAL TECHNIQUES.

The application of the calculus of variations. Pontryagin maximum principle, and dynamic programming to the design and control of chemical process equipment. Systems described by both ordinary and partial differential equations. Topics include: optimal reactor design, the synthesis of optimal control systems and optimal periodic operation of processing units. Prerequisite, Math. 187.

392 (II). SEMINAR. Preparation and discussion of professional topics. Prerequisite, Ch.E. 256, 257. 2 class hours. *Credit, 2.*

Civil Engineering

Head of Department: Professor Merit P. White. Professors Archer, Berger, Boyer, Carver, Feng, Halitsky, Hendrickson, Heronemus, Marcus, Nash, Osgood, Shuldiner, Weidmann, Zyczowski; Associate Professors Adrian, Adams, Bembien, Chajes, Colonell, Dzialo, Grow, Higgins, Miller, Stockton; Visiting Associate Professor Ward; Assistant Professors DiGiano, Foess, Harris, Kuzminski, Mangarella, Stokoe, Webster.

SOPHOMORE YEAR

1st Semester	Credits
Rhetoric	3
Math. 173, Analytic Geometry and Calculus III	3
Phy. 162, General Physics	4
CE 101, Surveying	3
CE 140, Statics	3
	16

2nd Semester	Credits
Humanities Elective	3
Math. 174, Analytic Geometry and Calculus IV	3
CE 180, Measurements and Analysis	3
CE 141, Strength of Materials	3
CE 257, Elementary Fluid Mechanics	3
Economics (D)	3
	18

JUNIOR YEAR

1st Semester	Credits
Math. Elective ⁽²⁾	3
CE 102, Transportation Location	3
CE 230, Theory of Structures	3
CE 280, Engineering Materials	3
CE 260, Engineering Hydraulics	3
CE 258, Fluid Mechanics Laboratory	1
	16

2nd Semester	Credits
CE 220, Soil Mechanics	3
CE 210, Transportation Systems	3
CE 270, Basic Environmental Engineering	4
CE 331, Design of Metal Structures	3
CE 142, Dynamics	3
	16

SENIOR YEAR

1st Semester	Credits
CE 333, Reinforced Concrete Structures	3
Science Elective ⁽³⁾	3
Humanities Elective	3
Professional ⁽⁴⁾ or Technical Electives ⁽⁵⁾	6
Engl. 331, Technical Writing	2
	17

2nd Semester	Credits
CE 396, Professional Problem	3
Social Science Elective	3
Professional ⁽⁴⁾ or Technical Electives ⁽⁵⁾	9
	15

⁽²⁾ Recommended: Math. 187, Math. 343, Math. 233, or COINS 251.

⁽³⁾ Recommended: Geology, Zoology, Biology, Microbiology.

⁽⁴⁾ Require department approval and must form a logical part of student's educational program.

⁽⁵⁾ Require department approval. Courses from Engineering, Mathematics, Physics, Chemistry, Geology, Botany, Microbiology, or Zoology Departments.

Note that any advanced ROTC study must be in addition to the normal load.

100 (II). PLANE SURVEYING.

Taping, transit, level, stadia, topographic surveying and mapping, care and adjustment of instruments. (Not accepted for credit for Civil Engineering majors.) Prerequisite, trigonometry. 2 class hours, 1 3-hour laboratory period.

101 (I). SURVEYING.

Theory of surveying. Use, care and maintenance of tape, transit, and level; traverse computation; topographic surveying and mapping; property surveying. Prerequisite,

site, trigonometry. 2 class hours, 1 3-hour laboratory period.

102 (I). TRANSPORTATION LOCATION.

Route location; horizontal and vertical alignment; construction computations. Prerequisite, CE 101. 2 class hours, 1 3-hour laboratory period.

140 (I), (II). STATICS.

Force systems, friction, first and second moments. Co-requisite, integral calculus concurrently.

141 (I), (II). STRENGTH OF MATERIALS I.

Simple and combined stresses and strains in tension, compression, and shear; torsion; stresses and deflections in beams. Prerequisite, statics.

142 (I), (II). DYNAMICS.

Motions of particles and rigid bodies and the force systems associated with these motions. Prerequisite, statics.

180 (II). MEASUREMENTS AND ANALYSIS.

Introduction to engineering measurements and analysis, relating scientific principles to engineering applications. Prerequisites, physics and chemistry; CE 141 and 257 concurrently. 1 class hour, 2 2-hour laboratory periods.

210 (II). TRANSPORTATION SYSTEMS.

Planning, design and operation of highway and railroad systems. Computer methods used in conjunction with laboratory design and planning problems. Prerequisite, CE 102. 2 class hours, 1 3-hour laboratory period.

220 (I), (II). SOIL MECHANICS.

Engineering uses and mechanical properties of soils. 2 class hours, 1 3-hour laboratory period.

222 (I). SOIL TESTING.

Sampling and testing of soils for engineering purposes. Prerequisite, CE 220. 1 class hour, 2 3-hour laboratory periods.

230 (I), (II). THEORY OF STRUCTURES I.

Analysis of statically indeterminate structures. Prerequisite, CE 141.

232 (I). THEORY OF STRUCTURES II.

Analysis of statically indeterminate structures. Prerequisite, CE 230.

234 (II). THEORY OF STRUCTURES III.

Analysis of complex or special structures. Prerequisites, CE 232, 331, 333 concurrently.

235 (II). MATRIX ANALYSIS OF STRUCTURES.

Development and use of the flexibility and stiffness methods of matrix analysis for determinate and indeterminate structures. (Formerly CE 735.) Prerequisite, CE 232.

240 (I). STRENGTH OF MATERIALS II.

Calculation of stresses and strains in components of machines and structures. Prerequisite, CE 141.

256 (I). INTRODUCTION TO HYDRODYNAMICS.

Mathematical treatment of basic theorems of classical hydrodynamics including potential flow, conformal

mapping, and wave and vortex motions. Prerequisite, Math. 186.

257 (II). ELEMENTARY FLUID MECHANICS.

Fundamentals of fluid mechanics including fluid properties, fluid behavior under static and dynamic conditions, and development of basic fluid flow equations. Prerequisite, statics.

258 (I). FLUID MECHANICS LABORATORY.

Laboratory investigations of fluid mechanics principles, pipe and open channel flow, hydraulic machinery, and fluid measurements. Prerequisite, CE 257. Corequisite, CE 260. 1 2-hour laboratory. *Credit, 1.*

259 (II). ENGINEERING OCEANOGRAPHY.

Fluid mechanics problems of ocean and coastal engineering including currents, tides, surface waves, tsunami and seiche phenomena, and ocean circulation. Prerequisite, CE 257.

260 (I). ENGINEERING HYDRAULICS.

Civil Engineering applications of fluid mechanics including analysis of water distribution and drainage systems, basic hydrology, fluid drag on structures, and hydraulic machinery. Prerequisite, CE 257.

261 (I). OPEN CHANNEL FLOW.

Steady flow in open channels including channel transitions and controls, sediment transport, and elementary design of related hydraulic structures. Prerequisite, CE 257.

270 (I), (II). BASIC ENVIRONMENTAL ENGINEERING.

Quantity, quality and treatment of water and wastewater. Air pollution and solid waste problems. Prerequisites, Chem. 112; CE 257 concurrently. 3 class hours, 1 3-hour laboratory period. *Credit, 4.*

271 (I). INTRODUCTION TO ENVIRONMENTAL POLLUTION CONTROL.

Basic engineering aspects of environmental pollution control. (For students not majoring in Civil Engineering.)

275. MICROMETEOROLOGY.

Physical and dynamical properties of the atmosphere and their effect on dispersion of airborne material. Methods of calculation of concentration fields in simple and complex flowfields. Practical approaches to the analysis of diffusion from point, jet and urban area sources. Review of research techniques for measuring diffusion parameters. Prerequisite, integral calculus. *Credit, 2.*

280 (I), (II). ENGINEERING MATERIALS.

Emphasis on physical behavior and the correlation between experiment and theory. Prerequisite, CE 141. 2 class hours, 1 3-hour laboratory period.

281. MATERIALS IN THE OCEAN ENVIRONMENT.

Treatment of the response of structural materials to the ocean environment; theory of corrosion, abrasion, erosion, and biological attack. Prerequisite, permission of instructor.

285 (II). CONSTRUCTION PROBLEMS.

Legal aspects of construction contracts; estimating and bidding; critical path scheduling.

286 (II). ENGINEERING GRAPHICS.

Theory and practice of engineering graphics. 2 3-hour lecture-laboratory sessions per week.

290. OCEAN ENGINEERING PAYLOAD DEVICES.

Techniques for augmentation of man's abilities in the sea. Underwater illumination, photography, manipulative and prosthetic devices, tools and instruments for underwater work. Prerequisite, permission of instructor.

291. OCEAN SYSTEMS ENGINEERING AND DESIGN.

Systems engineering applied to synthesis of systems capable of doing useful work in the deep oceans. Emphasis on design of submergence vessels. Prerequisite, permission of instructor. 3 class hours, 1 3-hour laboratory period. *Credit, 4.*

305 (I). ADVANCED SURVEYING.

Elements of astronomical, geodetic and photogrammetric surveying; coordinate systems and map projections. Prerequisite, CE 101. 2 class hours, 1 3-hour laboratory period.

311 (II). TRAFFIC ENGINEERING.

Engineering solutions to planning, design, and operations problems of urban and rural street and highway networks. Prerequisite, CE 210. 2 class hours, 1 3-hour laboratory period.

321 (I). FOUNDATION ENGINEERING.

Foundations and earth structures; interpretation of borings; analysis and design of piles, footings, piers, abutments and retaining walls. Prerequisite, CE 220.

323 (II). SOIL MECHANICS FOR TRANSPORTATION ENGINEERING.

Application of the principles of soil mechanics to the field of Transportation Engineering. Topics include the evaluation of the stability of soils as subgrade and embankment materials; the role of the subgrade properties of soils. Prerequisite, CE 220.

331 (I), (II). DESIGN OF METAL STRUCTURES.

Selecting and proportioning elements and connections of structural frames of buildings and bridges. Prerequisite, CE 230. 2 class hours, 1 3-hour laboratory period.

333 (I), (II). REINFORCED CONCRETE STRUCTURES.

Analysis and design of reinforced concrete structures. Prerequisite, CE 230.

334 (II). ADVANCED TOPICS IN CONCRETE.

Design of various types of reinforced concrete building frames; elastic theory and ultimate strength procedures. (Formerly CE 773.) Prerequisites, CE 232 and 333.

360 (I). HYDROLOGY.

The hydrologic cycle including precipitation, runoff, groundwater, flood routing, reservoir sedimentation, water law, and applications of hydrologic techniques to

water resources engineering. Prerequisite, CE 257 or permission of instructor.

362 (II). WATER RESOURCES ENGINEERING.

Planning and design of dams, reservoirs, and other related hydraulic structures, including analysis of existing and proposed water resources projects. Prerequisite, CE 257 or permission of instructor.

365. WATER INSTITUTIONS AND POLICIES.

Public policies and laws relating to the use and conservation of water resources. Analysis of water-related governmental organization and programs at the Federal, state and local levels. Prerequisite, permission of instructor.

371 (II). INDUSTRIAL WASTE TREATMENT AND CONTROL.

Composition of industrial effluents; pollution criteria and effects of industrial wastes on receiving waters; physical, chemical and biological methods and applications in treatment. Prerequisite, permission of instructor. 2 class hours, 1 3-hour laboratory period.

372 (I). ENVIRONMENTAL ENGINEERING ANALYSIS I.

Application of chemical principles to environmental engineering analysis with specific reference to pollution indices. Prerequisite, Chem. 112. 2 class hours, 1 3-hour laboratory period.

373 (II). ENVIRONMENTAL ENGINEERING ANALYSIS II.

The fundamental microbiological and biochemical properties of the microorganisms important in environmental engineering practice. Prerequisite, CE 372 or permission of instructor. 2 class hours, 1 3-hour laboratory period.

374. RADIOLOGICAL HEALTH ENGINEERING.

Basic principles and procedures pertaining to safe control of all common sources of ionizing radiation. Prerequisite, permission of instructor.

375 (II). SURFACE WATER QUALITY CONTROL.

Evaluation and control of water quality in streams, lakes and reservoirs. Mathematical analysis of patterns of water movement and their relation to water quality.

376 (I). SOLID WASTES.

The production, collection, transportation, treatment, and disposal of solid waste products (including municipal, industrial, and agricultural wastes). 2 class hours, 1 3-hour laboratory period.

385, 386. SPECIAL PROBLEMS.

Individual study of a selected problem for qualified students. By arrangement with members of the department. *Credit, 1-3.*

396 (II). PROFESSIONAL PROBLEM.

A problem relating to the student's area of interest in Civil Engineering studied under the direction of a member of the faculty. May be a joint project with students from Civil Engineering or other departments. Oral and written reports required. Prerequisite, senior standing.

Electrical Engineering

Chairman of Department: Professor G. Dale Sheckles. Professors Franks, Hutchinson, Langford, Lee, Monopoli, Navon, Van Atta; Associate Professors Bett, Edwards, Fitzgerald, Jackson, Laestadius, McIntosh, Mohn, Scott, Tang, Thomas, Yngvesson; Assisant Professors Bobrow, Ehrich, Glorioso, Herchenreder, Hill.

ELECTRICAL ENGINEERING OPTION SOPHOMORE YEAR

<i>1st Semester</i>	<i>Credits</i>
Humanities Elective (C)	3
Math. 173, Analytic Geometry and Calculus III	3
Phys. 162, General Physics II	4
EE 141, Systems Analysis I	4
MAE 135, Introduction to Materials Science	3
	17

<i>2nd Semester</i>	
Humanities Elective (C)	3
Math. 174, Analytic Geometry and Calculus IV	3
Phys. 163, General Physics III	4
EE 142, Systems Analysis II	4
	14

JUNIOR YEAR

<i>1st Semester</i>	<i>Credits</i>
Engl. 331, Technical Writing	2
EE 201, Electronic Materials and Devices	4
EE 257, Field Analysis I	4
EE 265, Random Signal Theory	3
Technical Elective	3
	16

<i>2nd Semester</i>	
EE 202, Active Networks I	4
EE 204, Circuit Theory	3
EE 205, Intermediate Laboratory	2
EE 210, Digital Circuit Theory	3
EE 258, Field Analysis II	4
	16

SENIOR YEAR

<i>1st Semester</i>	<i>Credits</i>
EE 275, Advanced Laboratory	2
EE 394, Professional Seminar	1
Technical Elective	3
Technical Elective	3
Social Science Elective (D)	3
Humanities Elective (C)	3
	15

<i>2nd Semester</i>	
EE 276, Advanced Laboratory	3
Technical Elective	3
Technical Elective	3
Social Science Elective (D)	3
Free Elective	3
	15

All elective courses listed in the above curriculum must be satisfied and must be approved by the adviser. Advanced Military or Air Science may be used for the free elective.

COMPUTER SYSTEMS ENGINEERING OPTION

SOPHOMORE YEAR

<i>1st Semester</i>	<i>Credits</i>
Humanities Elective (C)	3
Humanities Elective (C)	3
Math. 173, Analytic Geometry and Calculus III	3
Phys. 162, General Physics II	4
EE 141, Systems Analysis I	4
	17

<i>2nd Semester</i>	
Engl. 331, Technical Writing	2
Humanity Elective (C)	3
Math. 174, Analytic Geometry and Calculus IV	3
Phys. 163, General Physics III	4
EE 142, Systems Analysis II	4
	16

JUNIOR YEAR

<i>1st Semester</i>	<i>Credits</i>
Social Science Elective (D)	3
EE 201, Electronic Materials and Devices	4
CS 223, Machine and Assembly Language	3
EE 210, Digital Circuit Theory	3
Technical Elective	3
	16

<i>2nd Semester</i>	
Social Science Elective (D)	3
EE 265, Random Signal Theory*	3
EE 342, Non-numerical Processing	3
EE 344, Programming Structures	3
Technical Elective	3
EE 346, Laboratory I	1
	16

SENIOR YEAR

<i>1st Semester</i>	<i>Credits</i>
Non-technical Elective	3
Free Elective	3
CS 235, Comparative Machine Design	3
EE 350, Laboratory II	3
Technical Elective	3
	15

<i>2nd Semester</i>	
Non-technical Elective	3
Free Elective	3
EE 354, Laboratory III	3
CS 271, Operating Systems	3
Technical Elective	3
	15

*Math. 233, Probability, may be substituted for EE 265.

All elective courses listed in the above curriculum must be satisfied and must be approved by the adviser.

141 (I). SYSTEMS ANALYSIS I.
Physical characteristics and mathematical models of system elements; techniques for writing and solving system dynamic equations. Prerequisite, Engrg. 104 and Math. 124. 3 class hours, 1 3-hour problem period.
Credit, 4.

142 (II). SYSTEMS ANALYSIS II.
Concepts relating to transfer functions; digital and analog solutions of system equations, time and frequency domain analysis techniques and stability. Prerequisite, EE 141. 3 class hours, 1 3-hour problem period.
Credit, 4.

143 (II). INTRODUCTORY LABORATORY.

Laboratory techniques in circuits and systems appropriate to the level of sophomore engineers. Corequisite, EE 142. 1 3-hour laboratory period. *Credit, 1.*

201 (I). ELECTRONIC MATERIALS AND DEVICES.

Introduction to quantum theory of solids and quantum statistics, conduction processes in semiconductors and metals, theory of p-n junction diodes and transistors, field effect diode. Prerequisites, Physics 163, MAE 135. 4 class hours. *Credit, 4.*

202 (II). ACTIVE NETWORKS I.

Active network theory, emission, biasing, device models and linear equivalent circuits, tuned and untuned amplifiers, power amplifiers, feedback switching mode applications, interfacing and integrated circuits. Prerequisites, EE 142, 201. 4 class hours. *Credit, 4.*

203 (I). ACTIVE NETWORKS II.

Feedback amplifier and oscillators, band-pass amplifiers, mixing and frequency conversion, modulation and demodulation, noise, active filters, electronic instrumentation and systems, power supplies and regulators. Prerequisite, EE 202.

204 (II). CIRCUIT THEORY.

Concepts used in the analysis of electrical circuits and systems: Fourier transforms, amplitude and phase responses, elementary synthesis, introduction to non-linear and time-varying networks. Prerequisite, EE 142.

205 (II). INTERMEDIATE LABORATORY.

Laboratory techniques pertaining to electrical circuit theory, active network analysis and digital circuits appropriate to a junior year competence in electrical engineering. Prerequisite, junior standing. 2 3-hour laboratory periods. *Credit, 2.*

210 (II). DIGITAL CIRCUIT THEORY.

An introduction to the theory of digital circuits stressing general techniques for the analysis and synthesis of combinational and sequential logic systems. Prerequisite, junior standing.

241 (I). ENERGY CONVERSION I.

Electromechanical energy conversion. Dynamical systems analysis of incremental motion transducers and rotary energy converters. Prerequisites, EE 142, 257.

243 (II). ENERGY CONVERSION II.

Direct energy conversion. Batteries, fuel cells, thermoelectric, photovoltaic, thermionic and MHD generators. Prerequisite, EE 201.

257 (I). FIELD ANALYSIS I.

Vector calculus. Conservative and non-conservative fields. Static and time-varying electromagnetic fields. Maxwell's equations, relations between field and circuit theory. Prerequisites, Physics 163, Math. 174. 4 class hours. *Credit, 4.*

258 (II). FIELD ANALYSIS II.

Continuation of EE 257 with special emphasis on time varying electromagnetic fields and wave phenomena. Prerequisite, EE 257. 4 class hours. *Credit, 4.*

265 (I). RANDOM SIGNAL THEORY.

Introduction to probability and stochastic processes.

Correlation theory and its application to electrical engineering problems in communication and control systems. Prerequisite, EE 142.

266 (I). SIGNAL PROCESSING AND COMMUNICATION SYSTEMS I.

Principles of design of modern communication systems. Mathematical description of digital and analog signals. Basic limitations of modulation techniques and information capacity of transmission systems. Prerequisite, EE 142.

267 (II). SIGNAL PROCESSING AND COMMUNICATION SYSTEMS II.

Techniques for evaluating performance of modulation and information transmission systems. Extraction of signals from noise. Minimum error signals estimation and detection. Prerequisites, EE 265, 266, or permission of instructor.

270 (I). SOLID STATE DEVICES.

Review of transistor physics, recombination statistics, avalanche and tunneling phenomena, varactor diodes, Schottky diodes, thyristors, tunnel diodes, junction and MOS field-effect devices, p-n junction lasers. Prerequisite, EE 201.

271 (II). MICROELECTRONICS.

Principles and applications of microelectronics with particular emphasis on silicon monolithic integrated circuits. Fundamental limitations of microminiaturization, design constraints imposed by the monolithic technique, planar technology, digital and linear microcircuits. Prerequisite, EE 201.

275 (I). ADVANCED LABORATORY I.

Projects designed to provide the student with laboratory experience related to his technical electives. Prerequisite, senior standing. 2 3-hour laboratory periods. *Credit, 2.*

276 (II). ADVANCED LABORATORY II.

Laboratory techniques developed in EE 275 are used to carry out a concentrated study in the student's area of interest. Prerequisite, EE 275. 2 4-hour laboratory periods.

278 (I). DIGITAL SYSTEMS DESIGN.

The design of a digital system by the interface of subunits described in terms of register sets. The subunits are interfaced at the architectural level by a set of instructions and at the logic level by the Boolean equations derived from the corresponding register transfers. Prerequisite, EE 210.

286 (II). POWER SYSTEM ANALYSIS.

Power transfer diagrams, voltage studies, system stability criteria, short-circuit calculations, and protective methods. Prerequisite, EE 241.

287 (II). MARINE INSTRUMENTATION.

A survey of the oceanographic parameters of interest to ocean engineers; the theory of measurement for those parameters. Typical examples of existing measuring equipment.

288 (II). PULSE ELECTRONICS.

Analysis and design of circuits for the generation, transmission and processing of information by means of pulses. Prerequisite, EE 202.

290 (I). FEEDBACK CONTROL SYSTEMS I. Time domain and frequency domain analysis and synthesis techniques for linear continuous control systems. The relationships between these techniques. Prerequisites, EE 142 or permission of instructor.

291 (II). FEEDBACK CONTROL SYSTEMS II. Analysis of nonlinear continuous control systems; introduction to digital control systems and optimization techniques. Prerequisite, EE 290.

294 (I). MICROWAVE ENGINEERING I. Electromagnetic theory applied to microwave propagation in waveguides and coaxial lines. Microwave circuit theory with applications to passive microwave networks. Prerequisite, EE 258.

295 (II). MICROWAVE ENGINEERING II. Continuation of EE 294. Modern microwave components including filters, ferrite devices, multiport junctions, amplifiers and oscillators. Generation, radiation and detection of microwaves. Prerequisite, EE 294.

298 (I). BIOMEDICAL ENGINEERING I. Techniques and concepts from control and communication theory useful in biological, medical and psychophysical research. Prerequisite, permission of instructor.

299 (II). BIOMEDICAL ENGINEERING II. Engineering analysis of the visual, position-motion sensing, taste and smell biological communication channels; human tracking capabilities; analog and hybrid modeling. Prerequisite, EE 298.

306 (I). ACOUSTICS. The fundamentals of sound generation, propagation and detection. Applications of theory to underwater sound and human speech. Prerequisite, junior standing or consent of instructor.

311 (II). APPLIED NONLINEAR ANALYSIS. The analysis of nonlinear mechanical and electrical systems. Numerical, graphical and analytical methods used to determine the behavior of modern nonlinear devices. Prerequisite, Math. 174.

342. NON-NUMERICAL PROCESSING. Introduction to basic mathematical and logical concepts relevant to description and manipulation of information structures such as lists, trees, and graphs in LISP. Prerequisite, COINS 223.

344. PROGRAMMING STRUCTURES. Introduction to basic structures of algorithms and programming languages. Convergence of algorithms. Introduction to logic and programming languages for description and implementation of algorithms. Prerequisite, COINS 223.

346. COMPUTER SYSTEMS LABORATORY I. Introduction to digital logic as building blocks for computer systems. Basic types of logic and their characteristics are investigated. Corequisite, EE 210. 3 laboratory hours. *Credit, 1.*

350. COMPUTER SYSTEMS LABORATORY II. Subunits of digital computer systems and their control. Registers, accumulators, arithmetic units, and memories and their interconnection. Prerequisite, EE 346. 3 laboratory hours.

354. COMPUTER SYSTEMS LABORATORY III. Project laboratory in advanced computer systems engineering including designs of integrated hardware/software systems and studies of current computer techniques. Prerequisite, EE 350. 3 laboratory hours.

356. INTRODUCTION TO AUTOMATA THEORY. Formal processes of computation. Computability, automata, algorithms, recursive functions. Formal systems, computing power of machines, and automata as examples of formal systems.

360. COMPUTER GRAPHICS. Introduction to basic organization of computer-driven graphical display systems. Methods for generation and manipulation of vectors and characters for real-time display. Data structures for picture and text processing. Prerequisites, COINS 223, EE 342.

362. SELF-ORGANIZING SYSTEMS AND PATTERN RECOGNITION. Introduction to several aspects of self-organizing systems and pattern recognition including machine intelligence, adaptation, learning, and self repair.

366. ANALOG AND HYBRID COMPUTERS. For computer science or engineering students interested in the hybrid computer as a computational tool. Reviews analog and digital computers and their combination. Prerequisites, Math. 174, and Eng. 104, or COINS 131. 2 class hours, 3 laboratory hours.

368. ADVANCED SWITCHING THEORY. Topics of contemporary interest in digital switching theory and logical design. State-of-the-art techniques in computer hardware design. Prerequisite, EE 210.

385, 386. SPECIAL PROBLEMS. Individual study of a selected problem for qualified students. By arrangement with members of the department. *Credit, 1-3.*

394 (I). PROFESSIONAL SEMINAR. Current engineering developments discussed through student reports. Instruction in the preparation of papers for publication and their presentation before technical audiences. Prerequisite, senior standing. 1 class hour. *Credit, 1.*

Industrial Engineering & Operations Research

Head of Department: Professor Richard W. Trueswell. Professors Miser, Rising; Associate Professors Davis, Duffy, Giglio, Kaminsky, Kroner, Lippert, Rikkers; Assistant Professor Sadowski.

SOPHOMORE YEAR		
<i>1st Semester</i>		<i>Credits</i>
Rhetoric Elective		3
Physics 162, General Physics II		4
Math. 173, Analytic Geometry and Calculus III		3
I.E. 151, Problems and Model Formulation		3
Economics 125, Elements of Economics		3
		16

2nd Semester

Physics 163, General Physics III	4
Humanities Elective	3
Math. 174, Analytic Geometry and Calculus IV	3
I.E. 271, Basic Probability for Engineers	3
Engl. 331, Technical Writing	2
	15

JUNIOR YEAR

<i>1st Semester</i>	<i>Credits</i>
I.E. 272, Principles of Engineering Statistics	3
I.E. 379, Operations Research I	3
I.E. 353, Industrial Engineering Economics I	3
Math. 115, Linear Algebra	3
Electives*	6
	18

2nd Semester

I.E. 273, Simulation	3
I.E. 380, Operations Research II	3
I.E. 354, Industrial Engineering Economics II	3
Electives*	3
I.E. 260, Design of Man-Machine Systems I	3
	15

SENIOR YEAR

<i>1st Semester</i>	<i>Credits</i>
I.E. 378, Production Control	3
I.E. 261, Design of Man-Machine Systems II	3
Economics Elective	3
Electives*	6
	15

2nd Semester

Humanities Elective	3
Electives*	12
	15

*These 27 credit hours of electives must satisfy the following: 12 from any courses offered for credit in the University, nine in recognized engineering science courses (must include a sequence of at least two courses) and six in industrial engineering and/or engineering science.

151. PROBLEMS AND MODEL FORMULATION. Introduction to Industrial Engineering (I.E.) and Operations Research (O.R.). Describes practical problems that arise in these fields, and shows how theoretical models have been developed to help with their solutions. Survey of the main currents of I.E. and O.R. that will be developed further in later courses. Insights into the varied pursuits of professionals in these fields.

253. METHODS AND STANDARDS ENGINEERING.

The principles involved in the simplification of the work pattern and the design of the work place, and in the establishment of production standards. 3 class hours, 1 3-hour laboratory period. Prerequisite, I.E. 271, previously or concurrently. *Credit, 4.*

256. DATA PROCESSING AND INFORMATION HANDLING SYSTEMS.

Principles and applications of data processing and electronic computer systems for use by Industrial Engineers as a management tool for control and decision making. Prerequisite, permission of instructor.

260. DESIGN OF MAN-MACHINE SYSTEMS I. Introduction to principles of human factors engineering. Anthropometric, physiological and psychological data

sources. Data gathering and analysis techniques useful to designers and industrial engineers. Occupational health and safety standards. Includes lectures, demonstrations and experiments. Project option.

261. DESIGN OF MAN-MACHINE SYSTEMS II. Human factors data applications to design of equipment and industrial urban and vehicle environment. Decision processes, communication. Problems of layout in industry, hospitals, etc. Involves more complex problem application than I.E. 260. Includes lectures, demonstrations and experiments. Project option. Prerequisite, I.E. 260 or permission of instructor.

271. BASIC PROBABILITY FOR ENGINEERS. Probability theory including: sample spaces; discrete and continuous random variables; functions of random variables; marginal and joint probability, density and cumulative distribution functions; and moments. Prerequisite, Math. 124.

272. PRINCIPLES OF ENGINEERING STATISTICS.

Statistical principles as applied to engineering problems including: estimation, hypothesis testing, analysis of variance, design of experiments, sampling plans, statistical quality control. Prerequisite, I.E. 271.

273. INTRODUCTION TO SIMULATION METHODS.

The principles and methods of computer simulation for the analysis and design of complex systems. Problems associated with developing valid and meaningful conclusions from simulation experimentation; emphasis on experimental design, model validation and verification, and analysis of results. Prerequisites, I.E. 271 and basic knowledge of FORTRAN. (Also listed as G.B. 273.)

286. INDUSTRIAL ENGINEERING PRINCIPLES. Organization, plant location, plant layout, industrial costs, production control, production standards, incentives. For students other than industrial engineering majors. Prerequisite, junior standing.

288. MOTION AND TIME STUDY.

For junior and senior students outside the industrial engineering field. 2 class hours, 1 3-hour laboratory period. Prerequisite, junior standing.

341. HOSPITAL INDUSTRIAL ENGINEERING I. Introductory course in the application of Industrial Engineering techniques to hospital management. Emphasis on the institution of Industrial Engineering programs in hospitals and the choice of suitable projects. Guest lecturers.

342. HOSPITAL INDUSTRIAL ENGINEERING II. A projects course based upon material covered in I.E. 341. Study of previous Industrial Engineering projects in hospitals, followed by each student conducting a project of his own in a local hospital. Prerequisite, I.E. 341.

353, 354. INDUSTRIAL ENGINEERING ECONOMICS I-II.

An introduction to economic problems faced by engineers, comparison of alternatives in engineering projects, use of discounted cash flow techniques, breakeven and minimum cost points, and economic selection and replacement of structures and machines; decisions made

in the face of risk and uncertainty. Instruction wherever advantageous by the case method. Either course may be taken separately; 353 is a science course for engineers of all disciplines and other technically-oriented individuals. *Credit, 3 each semester.*

360. SAFETY ENGINEERING.

Design of equipment facilities and processes to minimize accidents. Evaluation and design of fire prevention equipment and accident control procedures in organizations. *Credit, 2.*

375. JOB EVALUATION.

The principles used to determine an evaluation of all occupations in order to establish an equitable rating between them, to establish sound wage and salary policies. Prerequisite, I.E. 151. *Credit, 2.*

376. TIME STUDY.

The principles involved in the establishment of production standards and their application in the management functions of cost accounting, estimating, production control incentives, budgetary control. Prerequisite, I.E. 151 concurrently except for Business Administration majors.

377. LAYOUT AND DESIGN OF ORGANIZATIONAL FACILITIES.

The principles applying to the determination and development of the physical relationship between plant equipment and operators considering the economy and effectiveness of operation. 1 class hour, 1 3-hour laboratory period. Prerequisites, MAE 102, and I.E. 151, or equivalents. *Credit, 2.*

378. PRODUCTION PLANNING AND CONTROL. Analysis of quantitative and qualitative techniques for production planning and control. Emphasis on their application to various production systems. Prerequisites, I.E. 272, 353, 380.

379. OPERATIONS RESEARCH I.

The formulation and analysis of deterministic models for decisions including linear programming, network, integer programming and dynamic programming models. A science course for engineers of all disciplines and other technically-oriented individuals. Credit not allowed students who have taken Management 253, 254.

380. OPERATIONS RESEARCH II.

Stochastic models: decision theory, game theory, queueing theory, inventory theory, and general Markov processes. Credit not allowed students who have taken Management 253, 254. Prerequisites, I.E. 271, 379.

382. WORK SIMPLIFICATION.

The principles involved in the simplification of means of doing work and in the application and use of these principles. 1 class hour, 1 3-hour laboratory period. Prerequisites, MAE 268, and I.E. 376 concurrently. *Credit, 2.*

385, 386. SPECIAL PROBLEMS.

Individual study of a selected problem for qualified students. By arrangement with members of the department. *Credit, 1-3.*

394. PROFESSIONAL SEMINAR.

Presentation of papers on important subjects and recent developments. 1 class hour. Prerequisite, senior standing. *Credit, 1.*

Mechanical and Aero-Space Engineering

Acting Head of Department: Professor John H. Dittfach. Professors Bates, Boothroyd, Crossley, Day, Dixon, Horvay, Zahradnik; Associate Professors Costa, Cromack, Fillo, McGowan, McLennan, Nelson, O'Byrne, Patterson, Poli, Ritter, Russell, Umholtz, Wilson, Zinsmeister; Assistant Professors Ambs, Goss, Jakus, Kirchhoff, Murch, Tartaglia.

MECHANICAL ENGINEERING SOPHOMORE YEAR

<i>1st Semester</i>	<i>Credits</i>
Rhetoric Elective	3
Math. 173	3
Physics 162	4
MAE 135, Introduction to Materials Science	3
MAE 137, Introduction to Materials Science Lab.	1
MAE 144, Mechanics I	3
	17

<i>2nd Semester</i>	
Humanities Elective	3
Math. 174	3
Physics 163	4
MAE 145, Mechanics II	3
MAE 163, Thermodynamics I	3
	16

JUNIOR YEAR

<i>1st Semester</i>	<i>Credits</i>
MAE 267, MAE Lab. I	3
MAE 246, Mechanics III	3
MAE 265, Fluid Mechanics	3
EE 141, Circuits I	4
MAE 284, MAE Analysis I	3
	16

<i>2nd Semester</i>	
MAE 264, Thermodynamics II	3
EE 142, Circuits II	4
MAE 235, Materials and Manufacturing	3
MAE 237, Materials and Manufacturing Lab.	1
MAE 293, Mechanical Engineering Design I	3
	14

SENIOR YEAR

<i>1st Semester</i>	<i>Credits</i>
MAE 279, MAE Lab. II	1
EE 290, Controls or Mathematics Elective	3
Social Science Elective	3
MAE 295, Mechanical Engineering Design II	3
Technical Elective	3
Technical Elective	3
	16

<i>2nd Semester</i>	
MAE 280, MAE Lab. III	2
MAE 291, MAE Analysis II	3
Social Science Elective	3
Humanities Elective	3
Technical Elective	3
Technical Elective	3
	17

MECHANICAL ENGINEERING

Materials Major

SOPHOMORE YEAR

1st Semester	Credits
Rhetoric Elective	3
Math. 173	3
Physics 162	4
MAE 135, Introduction to Materials Science	3
MAE 137, Introduction to Materials Science Lab.	1
MAE 144, Mechanics I	3
	17

2nd Semester

Rhetoric Elective	3
Math. 174	3
Physics 163	4
MAE 145, Mechanics II	3
MAE 163, Thermodynamics I	3
	16

JUNIOR YEAR

1st Semester	Credits
MAE 267, MAE Lab. I	3
MAE 246, Mechanics III	3
MAE 265, Fluid Mechanics	3
Chem. 285, Physical Chemistry	3
Chem. 160, Organic Chemistry	4
	16

2nd Semester

MAE 264, Thermodynamics II	3
MAE 235, Materials and Manufacturing	3
MAE 237, Materials and Manufacturing Lab.	1
EE 201, Electronic Materials and Devices	4
Technical Elective	3
Social Science Elective	3
	17

SENIOR YEAR

1st Semester	Credits
MAE 308, Physical Metallurgy	3
Ch.E. 370, Polymer Science Application	3
MAE 279, MAE Lab. II	1
MAE 220, Materials Processing	3
Mathematics Elective	3
Technical Elective	3
	16

2nd Semester

MAE 350, X-Ray Diffraction	3
MAE 280, MAE Lab. III	2
Social Science Elective	3
Humanities Elective	3
Technical Elective	3
Technical Elective	3
	17

AERO-SPACE ENGINEERING

SOPHOMORE YEAR

1st Semester	Credits
Rhetoric Elective	3
Math. 173	3
Physics 162	4
MAE 135, Introduction to Materials Science	3
MAE 137, Introduction to Materials Science Lab.	1
MAE 144, Mechanics I	3
	17

2nd Semester

Humanities Elective	3
Math. 174	3
Physics 163	4
MAE 145, Mechanics II	3
MAE 163, Thermodynamics I	3
	16

JUNIOR YEAR

1st Semester	Credits
MAE 267, MAE Lab. I	3
MAE 246, Mechanics III	3
MAE 265, Fluid Mechanics	3
EE 141, Circuits I	4
MAE 284, MAE Analysis I	3
	16

2nd Semester

MAE 264, Thermodynamics II	3
EE 142, Circuits II	4
MAE 274, Flight	3
MAE 248, Aero-Space Structures	3
Humanities Elective	3
	16

SENIOR YEAR

1st Semester	Credits
Social Science Elective	3
MAE 287, Gas Dynamics	3
MAE 279, MAE Lab. II	1
Technical Elective	3
Technical Elective	3
EE 290, Controls	3
	16

2nd Semester

MAE 280, MAE Lab. III	2
MAE 278, Aero-Space Propulsion	3
Technical Elective	3
Technical Elective	3
Mathematics Elective	3
Social Science Elective	3
	17

SUPPLEMENTARY RULES AND PROCEDURES

1. *Honors* — Sophomore, junior, or senior students who are selected for their outstanding performance by the Undergraduate Committee are eligible to participate in the Department's Honors program. Curriculum, other than School and University requirements, is completely open subject to the approval of the Honors Adviser, the Undergraduate Committee and Department Head. It is expected that Honors students will cover the Departmental core material but not necessarily by taking the regularly specified courses. Special Departmental recognition will be extended to the Honors students.
2. *ROTC* — No ROTC credits are acceptable in fulfillment of the 128 credit hour degree requirements of the Department.
3. *Non-Technical Electives* — Students may substitute one Non-Technical Elective for a Technical Elective provided the student presents evidence in writing that such a substitution is beneficial to the planned program. The substitution must have the approval of the student's Adviser and the Department Head.

4. **Technical Electives** – Technical electives may be satisfied by upper level courses in Engineering, Mathematics, Computer Science, or Physics, or by upper or lower level courses in Chemistry or the Life Sciences.
5. **Mathematics Electives** – Mathematics electives may be satisfied by upper level Mathematics or Computer Science courses, or by Probability and Statistics in Industrial Engineering.
6. **Technical Communication** – Any student paper or report considered poor on the basis of technical communication by any instructor will be submitted to a Technical Communication Committee for review, comment, and recording. Such reports will be required to be redone. Students who show consistently poor communications performance may be required by the Committee to take a course in Technical Writing in their senior year.

135 (I). INTRODUCTION TO MATERIALS SCIENCE.

The atomic and molecular phenomena responsible for the behavior of materials. The relationship between the atomic structure of materials and their behavior is emphasized. Prerequisite, Chem. 112 or 114.

137 (I). INTRODUCTION TO MATERIALS SCIENCE LABORATORY.

Laboratory work to illustrate the concepts and principles of materials science. Prerequisite, MAE 135 concurrently. 1 3-hour laboratory period. *Credit, 1.*

144 (I), (II). MECHANICS I (STATICS).

A vector treatment of the equilibrium of particles and rigid bodies. Topics include: vector algebra, forces, moments, couples, equations of equilibrium, free-body diagrams, graphical techniques, constraints, structures and mechanisms, friction, centroids and moments of inertia, the method of virtual work. Prerequisites, Math. 124, Physics 161.

145 (I), (II). MECHANICS II (STRENGTH OF MATERIALS).

Notions of stress, strain, and Mohr's circle. Tension shear and torsion. Plane stress and plane strain; moments of inertia. Shear force and bending moment diagrams. Deflection of beams; indeterminate beams; Castigliano's principle; plastic bending of beams. Mechanical properties of materials. Prerequisite, MAE 144.

163 (II). THERMODYNAMICS.

The laws of thermodynamics introduced and applied to various energy-transforming devices. Property relations. Emphasis is on the science of thermodynamics, providing a background for further study in those areas that involve thermodynamic principles. Prerequisites, Physics 162, Math. 173.

200. PROFESSIONAL SEMINAR.

History of technology, criticisms of modern technology, technological change and assessment, and the role of the engineer and his professional organizations.

220 (I). MATERIALS PROCESSING.

Analysis of the metal cutting process including mechanics of metal cutting, temperature generated, tool life and tool wear, cutting fluids and surface roughness,

economics. The grinding process and electrical machining process. Analysis of metal forming processes including wire drawing, extrusion, deep drawing rolling, blanking. Prerequisite, senior standing.

221 (II). **AUTOMATION IN MANUFACTURING.** Fundamentals of parts feeding, orientation and mechanized assembly including analysis of transfer machines parts feeders; the performance and economics of assembly machines. Numerical control of machine tools including studies of control systems, planning procedures and economics. Prerequisite, senior standing.

235 (II). **MATERIALS AND MANUFACTURING.** The mechanical behavior of materials. Dislocations, material failures, creep, fatigue. Processing materials by plastic deformation and machining. Friction, lubrication, and wear. Casting and joining processes. Prerequisites, MAE 135 and 145.

237 (II). MATERIALS AND MANUFACTURING LABORATORY.

Laboratory work associated with MAE 235. Prerequisite, MAE 235 concurrently. 1 3-hour laboratory period. *Credit, 1.*

246 (I), (II). MECHANICS III (DYNAMICS).

A vector treatment of dynamics. Kinematics of a particle in two and three-dimensions. Dynamics of a particle; momentum, moment of momentum, and work-energy. Rigid bodies in plane motion; kinematics, and dynamics. Relative motion. Prerequisite, MAE 144.

248 (II). STRUCTURES FOR MECHANICAL AND AERO-SPACE ENGINEERS I.

Introduction to the load and temperature environment of structures. Review of stress and strain with an introduction to the theory of elasticity. Theories of bending, extension, torsion and shear of slender beams without structural discontinuities. Introduction to work-energy principles and their application to the deflection and stress analysis of complex structures. Examples from the fields of mechanical and aero-space engineering. Prerequisite, MAE 145.

249 (I). STRUCTURES FOR MECHANICAL AND AERO-SPACE ENGINEERS II.

A continuation of MAE 248. Elastic instability. Applications to axially symmetrical problems, curved beams and stress concentrations. Applications to plates and shells. Introduction to problems involving viscous and plastic behavior. Numerical methods. Prerequisite, MAE 248, or permission of instructor.

254 (I). PRODUCT DESIGN I.

Human values in design. Central philosophy of product design, with emphasis on the relation between technical and human values, creativity, and design methodology. Laboratory includes development of simple product concepts visualized in rapidly developed three-dimensional mockups. 2 class hours, 2 2-hour laboratory periods.

255 (II). AQUACULTURAL ENGINEERING SYSTEMS.

Rate theory and similitude in the scale-up of biological processes. Case study of biological data used in the derivation of useful engineering system design relationships for the culture of mollusks. A bioengineering

comparison of several systems used in aquaculture. Field trip to inspect an aquacultural project in operation.

257 (II). PRODUCT DESIGN II.

Continuation of MAE 254, Product Design I. 2 class hours, 2 2-hour laboratory periods.

264 (II). THERMODYNAMICS II.

Application of the laws of thermodynamics to energy conversion devices. Introduction to irreversible thermodynamics. Prerequisite, MAE 163.

265 (I). FLUID MECHANICS.

Vector approach to the fundamentals of fluid dynamics, including the topics of fluid statics, kinematics of fluids, potential flow, vorticity, dimensional analysis. Introduction to viscous fluids and compressibility. Prerequisite, MAE 163.

267 (I). MECHANICAL AND AERO-SPACE ENGINEERING LABORATORY I.

Calibration and application of instruments used in the testing of mechanical engineering apparatus. Introduction to the theory of experimentation. Prerequisite, MAE 163. 2 class hours, 1 3-hour laboratory period.

268 (II). KINEMATICS.

Mechanism, including velocity and acceleration diagrams, instant centers, gear teeth and gear trains, cams, and various speed transmissions. Prerequisite, MAE 246. 2 class hours, 1 3-hour laboratory period.

274 (II). FLIGHT VEHICLE PERFORMANCE.

Aircraft performance static and maneuvering. Fundamental astronautics, two-body problem, transfer orbits, rendezvous, intercept, lunar and interplanetary trajectories.

275 (II). AIR CONDITIONING AND REFRIGERATION.

Principles and applications of air conditioning and refrigeration. Comfort conditions, load calculations, systems analysis and design, case studies, plant visits. Prerequisite, MAE 264.

276 (II). COMBUSTION.

Phenomenological study of combustion processes in flowing systems. Prerequisite, MAE 264.

277 (I). INTRODUCTION TO PROPULSION POWER PLANTS.

Thermodynamic and performance aspects of reciprocating gasoline and diesel engines. Prerequisite, MAE 264.

278 (II). AERO-SPACE PROPULSION.

Primary and auxiliary power sources. Matching of air-breathing and rocket motor with vehicle. Electrical and nuclear propulsion systems. Prerequisite, MAE 287.

279 (I). MECHANICAL AND AERO-SPACE ENGINEERING LABORATORY II.

The theory and design of complete engineering experiments. Analog computer techniques. Prerequisite, MAE 267. 1 3-hour laboratory period. *Credit, 1.*

280 (II). MECHANICAL AND AERO-SPACE ENGINEERING LABORATORY III.

The conception, design, fabrication, and test of an engi-

neering experiment. Prerequisite, MAE 279. 2 3-hour laboratory periods. *Credit, 2.*

282 (I). HEAT TRANSFER.

Conduction, convection and radiation, with engineering applications. Prerequisites, MAE 163; Math. 174 or 241.

283 (I). MACHINE DESIGN.

Principles of the design of various machine parts; economy of manufacture, safety, styling, invention and creativity. Prerequisites, MAE 235, 237, and 293. 2 class hours, 1 3-hour laboratory period.

284 (II). MECHANICAL AND AERO-SPACE ENGINEERING ANALYSIS I.

Engineering problem solving emphasizing problem recognition and formulation, simplifying assumptions, and valid analytical processes. Prerequisite, Math. 174. 2 class hours, 1 3-hour laboratory period.

285 (I). VIBRATIONS I.

Elements of vibration theory, vibration isolation, absorbers, instrumentation, analysis of equivalent masses and shaft systems. Dynamic balancing. Prerequisite, MAE 246.

286 (II). ADVANCED MACHINE DESIGN.

Continuation of 283. Additional elementary parts and some complete machines. Emphasis on invention and creativity. Prerequisite, MAE 283. 2 class hours, 1 3-hour laboratory period.

287 (I). GAS DYNAMICS.

Continuous and discrete media. Compressible flow equations and compressibility effects. Flow in variable area ducts, normal and oblique shocks. Two dimensional flow. Applications. Prerequisites, MAE 163 and 265. *Credit, 4.*

288 (I). PHYSICS OF SOLIDS.

Mechanical, electrical, magnetic and thermal properties of engineering materials. Prerequisites, Chem. 112 or 114, Physics 162 or 125 or their equivalents.

291 (II). MECHANICAL AND AERO-SPACE ENGINEERING ANALYSIS II.

Continuation of MAE 284. Emphasis on more complex problems and more advanced mathematical methods. Prerequisite, MAE 284.

293 (II). MECHANICAL ENGINEERING DESIGN.

Introduction to the engineering design process, inventiveness, optimization, and decision-making. Prerequisite, MAE 284. 3 class hours, 1 3-hour laboratory period. *Credit, 4.*

294. MECHANICAL AND AERO-SPACE SYSTEMS ANALYSIS.

Application of engineering analysis techniques to large scale systems. Concepts and methodology of systems engineering. Prerequisite, EE 142 or permission of instructor.

295 (I). MECHANICAL AND AERO-SPACE ENGINEERING DESIGN.

Application of fundamentals and technology to complex design projects. Prerequisite, senior standing. 1 class hour, 2 3-hour laboratory periods.

- 301 (I). **ADVANCED ENGINEERING ANALYSIS AND DESIGN I.**
 An integration of fundamental physical laws with mathematical theory. Utilization of physical principles in a rigorous study of analysis and design methods in engineering. Application of graphical, numerical, and mathematical methods to realistic problems is emphasized. Prerequisite, graduate standing or permission of instructor.
- 303 (I). **THERMODYNAMICS.**
 Review of classical thermodynamics and conventional energy conversion. Statistical thermodynamics. Introduction to irreversible thermodynamics and direct energy conversion. Prerequisite, graduate standing or permission of instructor.
- 305 (I). **CONTINUUM ANALYSIS.**
 A unified treatment of the analysis of continua. Continuity, thermal and mechanical energy, entropy production, stress, strain, equations of motion, rotation, rate of strain and vorticity. Application to thermodynamics, fluid dynamics, heat conduction and convection, elasticity, and thermoelasticity. Prerequisite, graduate standing or permission of instructor.
306. **ADVANCED FLUID MECHANICS.**
 Review of kinematics of fluids and fluid dynamics; inviscid fluids; viscous fluid dynamics; incompressible, laminar flows; introduction to boundary layer theory. Prerequisite, MAE 265 or equivalent.
- 307 (I). **ADVANCED DYNAMICS.**
 Advanced dynamics of particles, systems of particles,

- variable mass systems, and rigid bodies. Gyroscopic motion. Rotating and accelerating frames of reference. Use of energy methods. LaGrange's equations, Hamilton's principle, and Eulerian angles in engineering problems. Prerequisite, graduate standing or permission of instructor.
- 308 (I). **PHYSICAL METALLURGY PRINCIPLES.**
 Principles underlying the structure and behavior of metals. Atomic arrangements, crystalline imperfections and X-ray. Equilibrium and non-equilibrium phase relationships in one-, two-, and three-component systems. Kinetics of diffusion and nucleation. Phase transformations, heat treatment and hardenability. Prerequisite, graduate standing or permission of instructor.
315. **AERODYNAMICS.**
 Application of theoretical fluid mechanics to aerodynamics including topics of theory of lift; finite wing theory; the effect of compressibility and viscosity on lift and drag; slender body theory.
316. **STABILITY AND CONTROL OF VEHICLES.**
 Introduction to the general concept of stability of motion. The stability of motion of air, space and ground vehicles.
- 350 (II). **X-RAY DIFFRACTION.**
 Principles of crystallography. X-ray diffraction. Prerequisite, MAE 308.
- 385, 386. **SPECIAL PROBLEMS.**
 Individual study of a selected problem for qualified students. By arrangement with members of the department.
Credit, 1-3.

School of Home Economics

BRUCE R. MORRIS, *Dean*
 Winifred I. Eastwood, *Director, Head of Extension Division for Home Economics*

PLEASE NOTE: The various curricula of the School of Home Economics are undergoing revision and are expected to be changed greatly in the near future. Please consult the School for changes currently planned in the program in which you are interested.

Home Economics Education

Head of Department: Associate Professor Helen R. Vaznaian; Professor Merchant; Assistant Professor Sullivan; Instructor Isles.
 In the fall of 1971, the areas of Home Economics Education, Cooperative Extension, and Management and Family Economics were integrated as one department, in an effort to expand opportunities in community service education.

HOME ECONOMICS EDUCATION

MAJOR IN HOME ECONOMICS EDUCATION, COOPERATIVE EXTENSION, AND MANAGEMENT AND FAMILY ECONOMICS		
I. <i>General Education Requirements</i>		<i>Credits</i>
Communications		6
Humanities		12
Math. and the Natural Sciences		9-10
Social Sciences		18
		45-46
II. <i>Departmental Requirements</i>		
Departmental Majors will meet the above requirements as follows:		
Communications:		
Rhetoric 100		3
Rhetoric 110		3
Humanities:		
History 150 or 151		3
9 credits selected from courses identified by the letter "C"		9
Math. and the Natural Sciences:		

Option I:	
9 credits selected from courses identified by the letter "E"	9
Option II:	
Chemistry 110	3
Chemistry 160	4
Plus one 3-credit course selected from courses identified by the letter "E"	3
Social Sciences:	
Sociology 101, Introductory	3
Psychology 101, Elementary	3
Economics 125, Elements of	3
9 credits selected from the following:	
Sociology 256, 251, 159, 175, 272, OR Psychology 261, 163, OR Economics 361, OR Anthropology 104, 366	9
III. Education (Meets state certification requirements)	
Psychology 301, Educational	3
Education 251, Foundations of Education	3
Education 282, Pre-Practicum	1
Education 285, Observation & Student Teaching	9
HEEd. 120, Introduction to Home Economics	1
HEEd. 382, Curriculum & Methods in Home Economics	4
HEEd. 388, Problems in Home Economics Education	3
HEEd. 390, 391, Seminar in Home Economics Education	1-3
	25-27
IV. Human Development	
HD 270, Child Development OR Psychology 261, Child Psychology	3
HD 380, Human Development in Adolescence & Young Adulthood OR Sociology 257, The Family	3
HD 381, Laboratory School Management	3
HD 383, Student Teaching in the Laboratory School	3
	12
V. Nutrition and Food	
NF 127, Man and Nutrition	3
NF 373, Nutrition During Growth and Development	3
6 credits selected from the following:	
NF 130 or 156, 251, 350, 360, or Hotel & Rest. Admin. 367	6
	12
VI. Textiles, Clothing and Environmental Arts	
TCEA 123, Art for Living	3
TCEA 124, Textiles I	3
TCEA 128, Apparel Design I, OR TCEA 253, Apparel Design II	3
TCEA 141, Man and Clothing	3
	12
VII. Management and Family Economics	
MFE 250, Family Management & Decision Making	3
MFE 274, Consumer Attitude & Demand, MFE 387, Problems in Consumer Economics, OR MFE 377, Theory & Application of Management	3
	6
VIII. Electives	12-15
Total Credits	124-130

120. INTRODUCTION TO HOME ECONOMICS.	
Development, scope and character of home economics as a general and professional field of study; breadth and depth of professional opportunities. 1 class hour.	
	Credit, 1.
261. COMMUNICATION BY DEMONSTRATION METHODS.	
Adaptation of the learning process to the demonstration method of communicating. Prerequisites, Rhetoric 110, 6 credits in major area, or permission of instructor. 1 class hour, 2 2-hour laboratory periods.	
381. ADULT EDUCATION IN HOME ECONOMICS.	
Organization of material, selection, use and evaluation of teaching techniques suited to group work with adolescents and adults. Credit toward meeting state standards for teachers and A.D.A. requirement. Prerequisite, minimum 6 credits in major area. 2 class hours, 1 2-hour laboratory period.	
382. CURRICULUM AND METHODS IN HOME ECONOMICS.	
Organization, scope and sequence of learning experiences in home economics education. Philosophy and content of curriculum, development of resource units, and methods of teaching. Prerequisites, Psych. 301, 263, and Educ. 251. 4 class hours.	Credit, 4.
385, 386. SPECIAL PROBLEMS.	
Individual study of a selected problem for qualified students. By arrangement with members of the department.	
	Credit, 1-3.
390-392. SEMINAR IN HOME ECONOMICS EDUCATION.	
Reports and discussion of current research studies in Home Economics Education. Prerequisite, junior standing. 1-3 class hours.	
MANAGEMENT AND FAMILY ECONOMICS	
250. FAMILY MANAGEMENT AND DECISION-MAKING.	
The integrated nature of management in the family; values and goals as reflected in decision-making about family resources. Prerequisites, Soc. 101 and Psych. 101, or permission of instructor.	
260. HOUSEHOLD EQUIPMENT.	
Physical principles, construction, materials, and economic considerations underlying selection, use and care of household equipment. 2 class hours, 1 2-hour laboratory period.	
274. CONSUMER ATTITUDES AND DEMAND.	
The motives, attitudes, and expectations of consumer behavior as influencing variables operating within and on the market. Prerequisites, Econ. 125, Psych. 101, Soc. 101, or permission of instructor. (Also listed as Marketing 278.)	
275. PERSONAL AND FAMILY ECONOMICS.	
Analysis of financial problems and alternatives available to individuals and families under changing conditions. Exploration of aspects of financial institutions affecting people in our economic society. Prerequisite, Econ. 125, or permission of instructor.	

377. **THEORY AND APPLICATION OF MANAGEMENT.**
 Theory and application of principles of effective home management: problem-solving applied to theoretical and practical situations. Prerequisite, MFE 250. 2 class hours, 1 2-hour laboratory period.

385, 386. **SPECIAL PROBLEMS.**
 Individual study of a selected problem for qualified students. By arrangement with members of the department. *Credit, 1-3.*

390-391. **SEMINAR IN MANAGEMENT AND FAMILY ECONOMICS.**
 Reports and discussion of current research studies in Management and Family Economics. Prerequisite, permission of instructor. 1-3 class hours. *Credit, 1-3.*

Human Development

Head of Department: Associate Professor Ellis G. Olim. Professor Burroughs; Assistant Professors Collard, Craig, Schumacher, Turner; Instructor Dumas.

	<i>Credits</i>
General Education	30
Physical Education	2
Pre-Professional	12
Human Development core courses	9
Additional requirements for major	15
Additional courses required for graduation (Professional and Electives)	54
Total Credits	122

- I. *General Education*

Rhetoric

History 100 or 101 OR a (C) Philosophy course

Two additional Humanities (C) courses

Zoology 101, Introductory (E)

Two additional Natural Science or Mathematics (E) courses

Psychology 101, Elementary (D)

Anthropology 104, Intro. to Cultural Anthropology (D)
- II. *Pre-Professional*

Psychology 270, Personality (D)

Psychology 325, Abnormal (D)

Two Sociology courses
- III. *Human Development Core Courses*

HD 270, Child Development

HD 370, Human Development in Adolescence and Young Adulthood

HD 380, Human Development in Adulthood*
- IV. *Major Requirements*

Human Development majors are required to take a minimum of 24 semester hours of credit. Core courses (see III above) are counted toward the 24-hour requirement. Also, Human Development courses listed in V. below may be counted toward the 24-hour requirement as well as any other courses described below in the description of courses.
- V. *Teacher Certification Requirements*

HD 381, Laboratory School Management

HD 382, Philosophy and Theories of Early Childhood Education

HD 383, Student Teaching in the Laboratory School

HD 384, Internship in a Child-Serving Profession

HD 385, 386, Special Problem: Laboratory School Workshops

TCEA 263, Art for the Young Child

Education 251, Foundations of Education (OR any allowable substitute)
- VI. *Special Professional Programs*
 Special programs may be arranged. Students should consult the Department for information.
- VII. *Electives*
 Students shall elect an additional number of courses to bring the total credit hours to at least 122.
- VIII. *Special Educational Programs*
 Students may elect a semester or two of study at the Merrill-Palmer Institute of Human Development, a semester or two at another university (in the United States or abroad), take courses in the other four colleges of the 5-college consortium or other special programs, such as BDIC, the Action Program, University Without Walls, etc. Courses taken in these programs may be counted toward the University's requirements for graduation. Qualified students may be accepted in the University's Commonwealth Scholar Program.
270. **CHILD DEVELOPMENT.**
 The child from the development point of view. Interaction of heredity and environment on development. Prerequisites, Soc. 101, Psych. 101, or permission of instructor.
272. **DIRECTED OBSERVATIONAL CHILD STUDY.**
 Directed experience in observation techniques with laboratory school children. Prerequisite, HD 270 or equivalent.
310. **LANGUAGE AND COGNITIVE DEVELOPMENT.**
 Language and cognition from the developmental point of view. The relationship between language and thought and changes in the relationship in the course of cognitive growth. Prerequisite, HD 270 or equivalent.
350. **RESEARCH METHODS IN HUMAN DEVELOPMENT.**
 Introduction to the methods of studying human development. Prerequisite, HD 270 or equivalent; may be taken concurrently with HD 270.
360. **THEORIES OF HUMAN DEVELOPMENT.**
 Major theories devised to explain human development. Emphasis on psychological theories and concepts. The relevance and relationship of biological, social and anthropological concepts. Prerequisite, HD 270 or equivalent.
- HUMAN DEVELOPMENT
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370. HUMAN DEVELOPMENT IN ADOLESCENCE AND YOUNG ADULTHOOD.

Human development during the second decade of life. Emphasis on biological, psychological, and sociological aspects. Theories of adolescent development. Prerequisite, HD 270 or equivalent, or permission of instructor. Open only to Human Development and Child Development majors.

380. HUMAN DEVELOPMENT IN ADULTHOOD. Human development from young adulthood through old age. A social, psychological perspective of change across the adult life span. Prerequisite, HD 270 or equivalent, or permission of instructor.

381. LABORATORY SCHOOL MANAGEMENT. Principles and methods of early childhood education. Teaching methods and curriculum planning for two- to five-year-old children. Prerequisite, HD 270 or equivalent.

382. PHILOSOPHIES AND THEORIES OF EARLY CHILDHOOD EDUCATION. Philosophy, theories and history of early childhood education. Field trips. Prerequisite, HD 381 or permission of instructor.

383. STUDENT TEACHING IN THE LABORATORY SCHOOL. Students plan, direct, and teach curriculum in the laboratory school under staff supervision. Prerequisite, HD 270.

384. INTERNSHIP IN A CHILD-SERVING PROFESSION. Teaching or work with normal or exceptional children, Head Start children, or the emotionally disturbed. Prerequisite, HD 270 or permission of instructor.

385, 386. SPECIAL PROBLEMS. Individual study of a selected problem for qualified students. By arrangement with members of the department. *Credit, 1-3.*

390-392. SEMINAR IN HUMAN DEVELOPMENT. Reports and discussion of current research studies in Human Development. 1-3 class hours. *Credit, 1-3.*

Nutrition and Food

Head of Department: Associate Professor Peter L. Pellett. Professor Wright; Associate Professors Beal, Bert, D. Davis, McCullough.

MAJOR IN DIETETICS AND INSTITUTIONAL ADMINISTRATION

I. General Education	Credits
Humanities, Fine Arts and Communications: Three courses identified by the letter "C"	9
Two Rhetoric courses, preferably 100 and 110	6
Social and Behavioral Sciences: Economics 125, Elements of Psychology 101, General Sociology 101, Introduction	3 3 3

Natural Sciences:	
Chemistry 110, General	3
Chemistry 160, Organic	4
Biochemistry 120, Introductory, or 220, Elementary	4
Zoology 101, Introductory	3
Zoology 135, Introductory Physiology	3
Microbiology 250, General	4

II. Department Requirements	
NF 127, Man and Nutrition	3
NF 130, Meal Management	3
NF 251, Principles of Food Preparation	3
NF 350, Quantity Food Management	4
NF 351, Institutional Administration	4
NF 352, Human Nutrition	3
NF 360, Experimental Foods	3
NF 372, Quantity Food Production	3
NF 375, Nutrition in Disease	3
NF 390, Seminar in Food	1
NF 391, Seminar in Nutrition	1
Management 214, Personal Management	3
Accounting 125, Introduction to	3

III. Limited Electives	
HEEd. 381, Adult Education in Home Economics, OR Psychology 301, Educational	3
Three of the following courses:	9
MFE 274, Consumer Attitudes and Demand	
MFE 377, Theory and Application of Management	
Public Health 123, Dynamics of Personal and Community Health	
Public Health 301, Principles of Community Health Education	
AFE 261, Food Marketing Systems	
AFE 265, Food Merchandising	
Statistics 121, Elementary	
One three-credit course from two of the following Departments in the School of Home Economics:	6
Human Development; Home Economics Education; Management and Family Economics; Textiles, Clothing and Environmental Arts	

IV. Electives	21
V. Physical Education	2
Total Credits	123

MAJOR IN FOODS IN BUSINESS

I. General Education	Credits
Humanities, Fine Arts and Communications: Three courses identified by the letter "C"	9
Rhetoric 100 and 110	6
Social and Behavioral Sciences: Economics 125, Elementary Psychology 101, General Sociology 101, Introductory	3 3 3
Natural Sciences: Chemistry 110, General Chemistry 160, Organic Zoology 101, Introductory Zoology 135, Introductory Physiology Microbiology 250, General	3 4 3 3 4

II. Department Requirements	
NF 127, Man and Nutrition	3
NF 130, Meal Management	3
NF 251, Principles of Food Preparation	3
NF 350, Quantity Food Production	4
NF 360, Experimental Foods	3
NF 373, Nutrition During Growth and Development	3
NF 390, Seminar in Foods	1
HEEd. 261, Communication by Demonstration Methods	3
MFE 250, Family Management and Decision-Making	3
TCEA 123, Art for Living	3
Marketing 201, Fundamentals	3
Marketing 222, Marketing Communications	3
Speech 201, Public Speaking	3
III. Limited Electives	
Journalism 201, Introduction to Communications	3
One of the following courses:	3
Speech 222, Radio Production	
Speech 223, Television Production	
Speech 224, Advanced Television Production and Direction	
English 337, Advanced Expository Writing	
English 339, Article Writing	
English 341, 345, 346, 347, Creative Writing	
One of the following courses:	3
AFE 261, Food Marketing Systems	
AFE 265, Food Merchandising	
AFE 368, Food Distribution Economics	
MFE 260, Household Equipment	
MFE 275, Personal and Family Economics	
Marketing 216, Marketing Management	
Marketing 221, Product Planning and Development	
Marketing 223, Marketing Network Analysis	
Marketing 224, Analysis for Pricing Decisions	
Biochemistry 120, Introductory, or 220, Elementary	
Statistics 121, Elementary	
Five three-credit courses from any of the following Departments in the School of Home Economics:	15
Human Development; Home Economics Education; Management and Family Economics; Textiles, Clothing and Environmental Arts	
IV. Electives	15
V. Physical Education	2
Total Credits	123

127. MAN AND NUTRITION.
Fundamentals of nutrition and its role in contemporary life. Development of man's food habits encompassing psychological, social, racial, economic and geographical factors.

130. MEAL MANAGEMENT.
Selecting foods, planning, preparing, and serving meals; emphasis on management of time, money, and energy. 2 class hours, 1 3-hour laboratory period.

NUTRITION AND FOOD

141. FUNDAMENTALS OF NUTRITION.
The science of nutrition and its importance in health professions. Open only to students of Nursing and allied professions. Prerequisite, Chem. 112.

156. FOOD PREPARATION AND SERVICE.
Basic food principles, purchasing, preparation and meal planning and service. Open to men and women. 2 class hours, 1 3-hour laboratory period.

251. PRINCIPLES OF FOOD PREPARATION.
Chemical and physical properties of food related to preparation and preservation. Prerequisite, Chem. 110 or equivalent. 2 class hours.

350. QUANTITY FOOD MANAGEMENT.
Management of food production in institutions, quality control, recipe standardization, portion and cost control, menu planning and work simplification. Prerequisite, NF 130 or 156. 2 class hours, 1 4-hour laboratory period. *Credit, 4.*

351. INSTITUTIONAL ADMINISTRATION.
Principles of organization, management, sanitation, food service planning and equipment selection. 3 field trips. Prerequisite, NF 130 or 156. 2 class hours, 1 4-hour laboratory period. *Credit, 4.*

352. HUMAN NUTRITION.
Absorption, utilization and interrelationship of food nutrients. Factors and critique of methods for determining nutrient requirements. Prerequisites, Biochem. 120 or 220 or permission of instructor.

360. EXPERIMENTAL FOODS.
Fundamental principles of food quality evaluation; development of independent research problem. Prerequisites, NF 251, Chem. 160, or permission of instructor. 1 class hour, 2 3-hour laboratory periods.

372. QUANTITY FOOD PURCHASING.
Food distribution and merchandising processes as they influence the purchasing of food for food service. Prerequisites, Acctg. 125, Econ. 125.

373. NUTRITION DURING GROWTH AND DEVELOPMENT.
Nutrition as it affects physical growth and development. Criteria for evaluating nutritional status of children. Prerequisite, NF 127 or 352.

375. NUTRITION IN DISEASE.
Physiological basis for therapeutic diets in certain diseases. Current medical and nutrition literature used. Prerequisites, NF 130, 352, Biochem. 120 or 220, Zool. 135, or permission of instructor.

385, 386. SPECIAL PROBLEMS.
Individual study of a selected problem for qualified students. By arrangement with members of the department. *Credit, 1-3.*

390. SEMINAR IN FOOD.
Reports and discussion of current research studies in Food. Prerequisite, permission of instructor. 1-3 class hours. *Credit, 1-3.*

391. SEMINAR IN NUTRITION.

Reports and discussion of current research studies in Nutrition. Prerequisite, permission of instructor. 1-3 class hours. *Credit, 1-3.*

392. SEMINAR IN INSTITUTIONAL ADMINISTRATION.

Reports and discussion of current research studies in Institutional Administration. Prerequisite, permission of instructor. 1-3 class hours. *Credit, 1-3.*

Textiles, Clothing and Environmental Arts

Acting Head of Department: Professor Bruce R. Morris. Professor Niederpruem; Associate Professors V. Davis, Hawes, Johnston, Paston; Assistant Professors Porter, Randall; Instructor Rainsford.

OPTION I

RETAIL EXECUTIVE INTERNSHIP

I. General Education	Credits
Communications:	
Rhetoric 100 and 110	6
Humanities and Fine Arts:	
Three letter "C" courses	9
Social Sciences:	
Three letter "D" courses	9
Math. and Natural Sciences:	
Three letter "E" courses	9
Physical Education	2
II Department Requirements	
TCEA 123, Art for Living	3
TCEA 124, Textiles I	3
TCEA 388, Problems in TCEA	3
TCEA 128, Apparel Design I, or 253, Apparel Design II	3
TCEA 141, Man and Clothing	3
TCEA 142, Fashion Marketing	3
TCEA 265, Clothing Selection and Design	3
TCEA 266, Fashion Accessories	3
TCEA 276, History of Decorative Arts	3
TCEA 374, Fashion Industries	3
TCEA 380, Retailing Field Experience (Merchandising Internship)	6
TCEA 390, Seminar in Creative Display	2
TCEA 391, Seminar in Contemporary Arts	2
Mktg. 201, Fundamentals of Marketing	3
MFE 274, Consumer Attitudes and Demand	3
Speech 201, Public Speaking	3
III. Restricted Electives	21
Must include a minimum of 6 credits in two areas listed below:	
Sociology, Anthropology, Psychology, Economics, Art, Journalism, Radio and TV, Language, Marketing, Management, Statistics, Computer Science	
IV. Electives	15
Total Credits	120

OPTION II

TEXTILE PRODUCE PROMOTION, TEXTILE AND APPAREL JOURNALISM, CONSUMER SERVICES AND MARKET RESEARCH

I. General Education	Credits
Communications:	
Rhetoric 100 and 110	6
Humanities and Fine Arts:	
Three letter "C" courses	9
Social Sciences:	
Three letter "D" courses	9
Math. and Natural Sciences:	
Three letter "E" courses	9
Physical Education	2
II Department Requirements	
TCEA 123, Art for Living	3
TCEA 124, Textiles I	3
TCEA 388, Problems in TCEA	3
TCEA 128, Apparel Design I, or 253, Apparel Design II	3
TCEA 141, Man and Clothing	3
TCEA 142, Fashion Marketing	3
MFE 274, Consumer Attitudes and Demand	3
Speech 201, Public Speaking	3
Marketing —	
three courses from recommended list	9
III. Departmental Electives	15
Elect courses from the following:	
TCEA 253, Apparel Design II	
TCEA 265, Clothing Selection and Design	
TCEA 266, Fashion Accessories	
TCEA 276, History of Decorative Arts	
TCEA 277, History of Costume	
TCEA 279, Interior Design	
TCEA 370, Textiles II	
TCEA 387, Problem in TCEA	
TCEA 390, Seminar in Creative Display	
TCEA 391, Seminar in Contemporary Arts	
IV. Restricted Electives	15-16
Minimum of 6 credits in two of the following areas:	
Speech, English, Journalism, Management, Marketing, Economics, Psychology, Sociology, Anthropology	
V. Electives	21-22
Total Credits	120

OPTION III

INTERIOR DESIGN AND THE ENVIRONMENTAL ARTS

I. General Education	Credits
Communications:	
Rhetoric 100 and 110	6
Humanities and Fine Arts:	
Three letter "C" courses	9
Social Sciences:	
Three letter "D" courses	9
Math. and Natural Sciences:	
Three letter "E" courses	9
Physical Education	2

II. <i>Department Requirements</i>	
TCEA 123, Art for Living	3
TCEA 124, Textiles I	3
TCEA 388, Problems in TCEA	3
TCEA 266, Fashion Accessories	3
TCEA 278, History of Decorative Arts	3
TCEA 278, Applied Design	3
TCEA 279, Interior Design	3
TCEA 370, Textiles II	3
TCEA 378, Advanced Interior Design	3
TCEA 390, Seminar in Creative Display	2
TCEA 391, Seminar in Contemporary Arts	2
TCEA 387, Problem in Interior Design	3
Art 115, Introduction to Art	3
Art 120, Basic Design I	3
Art 291, Modern Architecture	3
Art 295, American Art	3
Ag. Eng. 261, House Planning	3
Env. Des. 251, History and Theory	3
Env. Des. 261, Basic Design	4
IV. <i>Restricted Electives</i>	12
Minimum of 6 credits in two of the following areas:	
Speech, Economics, Psychology, Sociology, Anthropology, Marketing, Management, Journalism	
V. <i>Electives</i>	18
Total Credits	121

123. ART FOR LIVING.
Development of an understanding of the visual arts, particularly the relationship between art and life, through a study of the elements and principles of design in theoretical and applied form. Study tours. 2 class hours, 3 studio hours.

124. TEXTILES I.
Introductory study of fibers, fabrics, finishes of textile products related to their care and performance. Study tours. 2 class hours, 1 2-hour laboratory period.

128. APPAREL DESIGN I.
Basic principles in executing elementary apparel designs as a form of artistic expression. 1 class hour, 2 2-hour laboratory periods.

141. MAN AND CLOTHING.
The impact of clothing and textiles on the individual and society; sociological, psychological and economic implications as seen in historical and contemporary perspective. Prerequisite, Soc. 101 or Psych. 101.

142. FASHION MARKETING.
Analysis of socio-economic factors underlying distribution of fashion-oriented commodities from producer to consumer. Study tours. Prerequisite, Econ. 125.

253. APPAREL DESIGN II.
Study of patterns and fitting problems; development and use of master pattern in executing original designs. Prerequisite, TCEA 128, or permission of instructor. 1 class hour, 2 2-hour laboratory periods.

263. ART FOR THE YOUNG CHILD.
The teaching of art in relation to growth and development of children; program planning, evaluation and art resources. 2 class hours, 3 studio hours.

265. CLOTHING SELECTION AND DESIGN.
Basic criteria for selection and design of clothing for men, women and children. Prerequisites, TCEA 123 and 141, or permission of instructor.

266. FASHION ACCESSORIES.
Factors involved in production, distribution, selection and evaluation of accessories: leather goods and furs, jewelry, ceramics, glassware, silverware, plastics and furniture. Study tours. 2 class hours, 1 2-hour laboratory period.

276. HISTORY OF DECORATIVE ARTS.
The development of man's crafts from Ancient to Modern: furniture, ceramics, glass, precious metals, etc. Style as an insight into socio-historic context. Study tours.

277. HISTORY OF COSTUME.
Western costume from ancient civilizations to the present; exploration of the relationship of clothing to the period. Study tours.

278. APPLIED DESIGN.
Original designing emphasizing principles of organization. Application to heightened understanding in techniques and media. Prerequisite, TCEA 123, or Art 120, or permission of instructor. 1 class hour, 4 studio hours.

279. INTERIOR DESIGN.
Principles and practices of interior design including coordination of furnishings, backgrounds, accessories, color and lighting. Scale drawings, renderings, presentations and cost analysis. Studio study. 1 class hour, 4 studio hours.

370. TEXTILES II.
Analysis and evaluation of recent scientific and technical development in fibers and finishes. Study tours. Prerequisite, TCEA 124.

374. FASHION INDUSTRIES.
Development of foreign and domestic fashion industries with special emphasis on primary and secondary markets; evaluation of their importance to the economy. Prerequisite, Marketing 222 or 223.

378. ADVANCED INTERIOR DESIGN.
Advanced color theory. Investigation of professional sources for interior designers. Work problems in residential and commercial interiors. Study tours. 1 class hour, 4 studio hours.

380. RETAILING FIELD EXPERIENCE.
Supervised work-study program including 7-8 weeks off-campus experience in cooperating stores; evaluation of student's training, experience and development. Prerequisites, Marketing 222 or 223, TCEA 124, 142, 266, 6-8 weeks prior selling experience and permission of the department. *Credit, 6.*

385, 386. SPECIAL PROBLEMS.
Individual study of a selected problem for qualified students. By arrangement with members of the department. *Credit, 1-3.*

390-394. SEMINAR IN TEXTILES, CLOTHING AND ENVIRONMENTAL ARTS.
Reports and discussion of current research studies. Prerequisite, permission of instructor. 1-3 class hours. *Credit, 1-3.*

School of Nursing

LILLIAN R. GOODMAN, *Acting Dean*

Professors Earles, Helming, Winder; Associate Professors Clarke, Condron, Getchel, Nicholson, Petrunenko, Salenius, Sharp, Walker; Adjunct Associate Professor Murphy; Assistant Professors Eiben, Friedman, Hall, Hine, C. Hines, J. Hines, Johnson, Murphy, Redding, Sheridan, Smith, Sweeney, Whitbeck; Instructors Auton, Ceriala, Cole, Cotting, Craig, Dembishack, Economakos, Entrekin, Giles, Grancio, LaMonica, Lehman, Moynihan, Murdock, Reader, Shea; Lecturers Barkin, Driver, Haase.

All students in the School of Nursing are expected to fulfill the requirements as stated in each of the following areas:

General Education	Credits
Pre-Professional	45
Professional	14
Physical Education	62
Total Credits	2
I. General Education	123
Rhetoric "core" requirement	Credits
Humanities "core" electives	6
Behavioral and Social Science "core" electives	9
Natural Science "core" requirements (must be completed before entry to the junior year):	9
Chemistry 111 (4 credits)	12
Biochemistry 120 (4 credits)	
Microbiology 140 (3 credits)	
Microbiology 141 (1 credit)	
Electives	9
*Electives shown here are selected with the aid and consent of the student's adviser.	
II. Pre-Professional	Credits
Zoology 137 and 138, Human Anatomy and Physiology	8
A course in Normal Nutrition	3
A course in Human Development	3
III. Professional	
Freshman Year:	
Nursing 100, Introduction to Nursing	3
Sophomore Year:	
Nursing 110 and 111, Fundamentals of Nursing	8
Junior Year:	
Nursing 200 and 210, Nursing of Child and Adult	24
Senior Year:	
Nursing 300, Maternal and Infant Nursing	6
Nursing 301, Nursing in the Community	6
Nursing 302, Psychiatric-Mental Health Nursing	6
Nursing 303, Administration of Nursing Care	6
Nursing 390, Professional Foundations of Nursing	3
Electives: Open to qualified junior and senior students:	

Nursing 385, 386, 387, 388,
Special Problems

Independent study of nursing problems

IV. Physical Education

2

100 (I), (II). INTRODUCTION TO NURSING.

Designed to assist the individual in personal and professional adjustment to nursing. Enrollment limited to students of nursing. Clinical Nursing Faculty.

110 (I). FUNDAMENTALS OF NURSING.

Aims at acquisition of beginning knowledge and skill considered basic to an effective nurse-patient relationship as well as technical skills. Selected experiences in the nursing care of the adult in health agencies. Prerequisite, Nursing 100. Fundamentals of Nursing Faculty. Credit, 4.

111 (II). FUNDAMENTALS OF NURSING.

Continuation of Nursing 110. Prerequisite, Nursing 110. Fundamentals of Nursing Faculty. Credit, 4.

200 (I). NURSING OF THE CHILD AND ADULT.

Selected health problems of children and adults, and impact of acute illness and hospitalization on the individual and his family. Correlated clinical practicum in the care of selected hospitalized patients aims at the acquisition of competence and judgment in administering comprehensive nursing care. Prerequisite, Nursing 111. The Medical and Surgical and Pediatric Nursing Faculty and allied professional staffs of community health agencies. Credit, 12.

210 (II). NURSING OF THE CHILD AND ADULT.

Selected health problems of children and adults, and impact of long-term illness and hospitalization on the individual and his family. Correlated clinical practicum in the care of selected hospitalized patients aims at the acquisition of competence and judgment in administering comprehensive nursing care. Medical and Surgical and Pediatric Nursing Faculty and allied professional staffs of community health agencies. Credit, 12.

300 (I), (II). MATERNAL AND INFANT NURSING.

Application of basic concepts and principles of nursing to care of mothers during maternity cycle and to newborn infants. Correlated practicum provides experience in care of selected mothers and infants in the hospital and home. Prerequisite, Nursing 200, 210. The Maternal and Child Nursing, Public Health Nursing and Mental Health Nursing Faculties; allied professional staffs of the Wesson Women's Hospital and other community health agencies. Credit, 6.

301 (I), (II). NURSING IN THE COMMUNITY.

Application of basic concepts of public health and public health nursing to the care of individuals, families and community groups. Correlated practicum provides experience in the care of selected individuals, families and groups served by official and non-official public health nursing services. Prerequisite, Nursing 200, 210. Public Health Nursing, Maternal and Child

Nursing and Mental Health Nursing Faculties; professional staffs of the Visiting Nurse Association of Springfield, the Springfield Health Department and other community health agencies. *Credit, 6.*

302 (I), (II). PSYCHIATRIC-MENTAL HEALTH NURSING.

Aims at acquisition of knowledge and skills needed to function with beginning proficiency as a professional nurse on psychiatric-mental health team. Correlated clinical practicum provides opportunity for establishing the basis for therapeutic communication with individuals and groups of patients with psychiatric problems. Prerequisite, Nursing 200, 210. Psychiatric-Mental Health Nursing Faculty and professional staffs of the Northampton State Hospital and other community health agencies. *Credit, 6.*

303 (I), (II). ADMINISTRATION OF NURSING CARE.

The professional's role in evaluating, planning and organizing nursing care which is relevant to specific conditions and responsive to changing demands. Pat-

terns of organization in a variety of clinical settings, with opportunity to apply principles to the nursing team. Prerequisite, Nursing 200, 210. Clinical Nursing Faculty and professional staffs of the Wesson Memorial Hospital and other community health agencies. *Credit, 6.*

385, 386. SPECIAL PROBLEMS.

Individual study of a selected problem for qualified students. By arrangement with members of the department. *Credit, 1-3.*

390 (I). PROFESSIONAL FOUNDATIONS OF NURSING.

Professional responsibilities and relationships of the nursing practitioner. Enrollment limited to senior students of nursing. *Staff.*

392 (I), (II). THE NURSING PROCESS.

The use of a definitive nursing process in the solution of clinical nursing problems. Emphasis on independent functions of the professional nurse. Correlated practicum provides opportunity to test the theoretical content. Prerequisite, junior or senior status. *Credit, 6.*

School of Physical Education

DAVID C. BISCHOFF, *Dean*

Professor Coffey, Assistant Professor Cobb

PHYSICAL EDUCATION FOR MEN

Head of Department: Professor H. J. VanderZwaag; Professor Zunic; Associate Professors Garber, Lewis, Loy; Assistant Professors Barber, Brosky, Gundersheim; Instructors Ariel, Berryman, Calkin, Callahan, Kjeldsen, Toohey.

PHYSICAL EDUCATION FOR WOMEN

Acting Head of Department: Professor Betty Spears; Associate Professors Gerber, Hubbard, Ogilvie, Riggs, Vendien, Wallace; Assistant Professors Patton, Peterson, Shute; Instructors Clark, Evans, Farr, Griffin, Kjeldsen, McEnroe, Morse, Purnell; Lecturer Cooper.

JOINT DEPARTMENTAL COURSES

*100. PHYSICAL EDUCATION.

Skills courses in sport, dance, equestrian, and other forms of physical activity available to all students in the University. *Credit, 1.*

*101. PHYSICAL EDUCATION.

Theoretical and/or skill instruction in sport, dance, and other forms of physical activity. 3 to 6 class hours or equivalent. *Credit, 1 or 2.*

*Each student in the University is required to complete 2 credits in physical education.

MAJOR ACTIVITY COURSES FOR WOMEN

Courses designed for women majors in physical education. Instruction focuses both on skill in the activity and

learning to teach the skill. Activities are offered in aquatics, gymnastics, and sports. 6 class hours. *Credit, 1.*

PE 102, Fundamentals

PE 103, Hockey I and II

PE 104, Gymnastics I

PE 105, Aquatics—Senior Life Saving

PE 106, Soccer—Speedball—Basketball I

PE 107, Volleyball I—Tennis II

PE 110, Syncro. Swim. and Aqua. Comp.

PE 111, Competitive Swim. and El. Diving

PE 115, Gymnastics II and III

PE 116, Gymnastic Teaching

PE 117, Rhythmic Gymnastics

PE 120, Hockey III and Basketball II

PE 121, Volleyball II and Softball

PE 122, Volleyball II and Lacrosse

PE 125, Officiating I

PE 126, Officiating II

MAJOR ACTIVITY COURSES FOR MEN

Courses designed primarily for men majors in physical education. Instruction focuses both on skill in the activity and learning to teach the skill. All majors must take basic skill courses in gymnastics, track and field, and aquatics. Other courses cover the wide spectrum of individual, dual, and team sports in this culture.

Credit, 1.

PE 130, Gymnastics

PE 131, Aquatics

PE 132, Weight Training and Conditioning

PE 133, Football Coaching

PE 134, Basketball

PE 135, Basketball Coaching

PE 136, Baseball

PE 137, Baseball Coaching

PHYSICAL EDUCATION

PE 138, Gymnastic Coaching
 PE 139, Wrestling
 PE 140, Wrestling Coaching
 PE 141, Lacrosse
 PE 142, Lacrosse Coaching
 PE 143, Hockey
 PE 144, Hockey Coaching
 PE 145, Soccer
 PE 146, Soccer Coaching
 PE 147, Squash and Handball
 PE 148, Tennis Coaching
 PE 149, Officiating

Credit, 2.

CO-ED MAJOR ACTIVITIES

PE 150, Swimming for the Handicapped
 PE 155, Educational Gymnastics
 PE 160, Bowling
 PE 161, Golf
 PE 162, Advanced Golf
 PE 163, Tennis and Badminton
 PE 164, Tennis Coaching
 PE 165, Track and Field
 PE 166, Track and Field Coaching
 PE 167, Volleyball
 PE 180, Folk and Square Dance
 PE 181, Improvisation
 PE 182, Dance I
 PE 183, Dance II
 PE 184, Dance III
 PE 185, Dance IV
 PE 186, Dance V
 PE 187, Ballet I
 PE 188, Ballet II

Credit, 1.

200. SOCIOLOGY OF SPORT AND PHYSICAL ACTIVITY.

Social action theory, group structure, social institutions, social processes, current cultural trends, and social problems in sport. Prerequisite, Soc. 101.

201. PSYCHOLOGY OF SPORT AND PHYSICAL ACTIVITY.

Variables of skilled performance; behavioral patterns and interactions in games, sports, and dance activities; evaluation of skilled performance. Prerequisite, Psychology 101.

202. HISTORY OF SPORT AND PHYSICAL ACTIVITY.

A survey of the history of sport, dance, and other forms of organized, physical activity throughout the Western world. Prerequisite, His. 100 or 101.

203. PHILOSOPHY OF SPORT AND PHYSICAL ACTIVITY.

A philosophical analysis of sport and physical activity. Consideration of the nature and values of sport and its role as a meaningful activity. Prerequisite, Philos. 105.

206. PERCEPTUAL MOTOR DEVELOPMENT.

Motor development in the child, particularly focusing on conditions affecting the learning of motor skills.

240. DANCE HISTORY.

History of dance as a performing art in Western culture.

243. DANCE PRODUCTION.

Dance production relating to both the artistic and tech-

nical direction of the performing art. 2 class hours, 1 2-hour laboratory period.

245. DANCE COMPOSITION.

Choreography. 1 class hour, 1 2-hour laboratory period. *Credit, 2.*

253. PHYSICAL EDUCATION FOR ELEMENTARY SCHOOLS.

Program content for elementary school physical education and methods used for teaching physical education activities at the elementary school level.

261. WORLD HISTORY OF SPORT.

Factors influencing the rise of sport and the role of sport in society. Prerequisite, PE 202.

263. ANALYSIS OF RHYTHM.

Analysis of rhythmic structure of music and its application to motor activity. 2 class hours, 1 2-hour laboratory period.

264. PHILOSOPHY OF SPORT.

A philosophical analysis of key concepts which influence the objectives and content of various programs in the broad realm of sport. Prerequisite, PE 203 or equivalent.

265. SOCIOLOGY OF SPORT.

Sport as a social institution, including structure and function. Topics include theories explaining the role of sport in society; the incidence, form, and regulation of sport in society; physical activity in contemporary society; and the social psychology of sport, including personality, attitude, and motivation. Prerequisite, PE 200.

275. PREVENTION AND CARE OF INJURY IN ACTIVITY.

Theory and techniques in preventing and treating all types of physical injuries including first aid treatment as well as therapeutic aids and clinical use of physiotherapy equipment. Prerequisite, PE 205. 2 class hours, 1 2-hour laboratory period.

276. PRINCIPLES OF PHYSICAL EDUCATION.

Aims and objectives in physical education; also presentation and critical analysis of curricular, methodological, and adapted principles as they apply to the teaching of physical education.

277. PSYCHOLOGY OF COACHING.

Analysis of psychological content in athletics and coaching. Topics include personality and motivation, mental health aspects, competitive spirit, sportsmanship, and selected problems in coaching pertaining to psychological factors. Prerequisites, Psych. 101 and 263 or permission of instructor.

354. PHYSICAL EDUCATION IN THE SCHOOL.

Content and presentation of methods designed to prepare the student for the educational internship in the schools. The applicability of micro-teaching techniques to situations in teaching physical education activities.

362. HISTORY OF SPORT IN THE UNITED STATES.

Sport in America from earliest times to the contemporary period. Emphasis on the social, political, and

economic factors which affected the development of sport. Prerequisite, PE 261.

363. COMPARATIVE SPORT.
A comparative analysis of sport and athletics in selected countries. Emphasis on historical, cultural, and social values affecting the status of sports and recreation, and current international cooperation. Prerequisite, PE 261.

370. ORGANIZATION AND ADMINISTRATION.
Discussion of administrative theory and practice as they relate to the program of physical education in the schools.

381. ADMINISTRATION OF INTRAMURAL PROGRAMS.
Objectives, tourney design, organization and administration of intramural programs. 2 class hours. *Credit, 2.*

385, 386. SPECIAL PROBLEMS.
Individual study of a selected problem for qualified students. By arrangement with members of the department. *Credit, 1-3.*

390. SEMINAR.
Analysis of studies and issues in physical education.

Exercise Science

Acting Chairman: Professor Benjamin Ricci, Professors Campney, Kroll; Associate Professors James, Plagenhoef; Assistant Professor Edington.

204. HUMAN ANATOMY.
Gross structure and function of the body. 2 lecture hours, 1 2-hour laboratory period.

205. KINESIOLOGY.
Anatomical application as a basis to a thorough understanding of mechanical problems in motor skills. Prerequisite, PE 204. 2 lecture hours, 1 2-hour laboratory period.

259. KINESIOTHERAPY.
Programs of developmental activities, suited to interests and capacities of students with disabilities who are restricted from participation in activities of the general physical education program. Prerequisite, PE 205.

274. THEORY OF MEASUREMENT AND EVALUATION.
Construction, interpretation, and evaluation of tests, including the theory of grading.

278. PHYSIOLOGY OF EXERCISE.
Application of basic physiological concepts of the program of physical education, emphasizing physiological effects and adjustments accruing from participation in physical activity. Prerequisite, Zool. 135. 2 class hours, 1 2-hour laboratory period.

321. PHYSIOLOGICAL BASIS OF HUMAN PERFORMANCE.
Analysis and interpretation of cardiovascular-pulmonary adjustment, metabolic requirement, and heat regulation during exercise. Prerequisite, PE 278. 2 class hours, 1 2-hour laboratory period.

RECREATION

331. MECHANICAL ANALYSIS OF HUMAN MOTION.
Application of the principles of mechanics to the analysis of human motion. Prerequisite, PE 205 or equivalent. 2 class hours, 1 2-hour laboratory period.

341. MOTOR INTEGRATION.
Examination of the control of muscular activity by the nervous system. Topics include basic motor system reflexes, cross transfer, fatigue, kinesthetic sense, lateral dominance, and neuromuscular facilitation techniques. Prerequisites, PE 205 and PE 278.

351. THEORY OF THERAPEUTIC EXERCISE.
The theory of therapeutic exercise for the mentally retarded, physically handicapped, and normal. Prerequisite, PE 259 or equivalent.

352. PHYSICAL ACTIVITY AND MENTAL RETARDATION.
Physical activity relative to the behavior of the mentally retarded. Prerequisite, PE 259. Mr. James.

385, 386. SPECIAL PROBLEMS.
Individual study of a selected problem for qualified students. By arrangement with members of the department. *Credit, 1-3.*

Recreation

Head of Department: Professor William E. Randall. Assistant Professor Sherrow; Instructors Robb, Willmann.

SOPHOMORE YEAR

<i>1st Semester</i>	<i>Credits</i>
Rec. 112, Program Activities II	3
Humanities and Fine Arts Elective (C)	3
Speech 201, Public Speaking	3
Sociology Elective*	3
Psychology Elective*	3
Rec. 003, Field Experience I	0
	15
<i>2nd Semester</i>	
Rec. 230, Group Leadership	3
Math. or Natural Science Elective (E)	3
Social Science Elective* **	3
Sociology Elective*	3
Option Course	3
Rec. 004, Field Experience II	0
	15

JUNIOR YEAR

<i>1st Semester</i>	<i>Credits</i>
Rec. 320, Recreation Facilities	3
English 337, Adv. Expository Writing	3
Social Science Elective* **	3
Two Option Courses	6
	15
<i>2nd Semester</i>	
Rec. 313, Leisure Service Programming	3
Option Courses	6
Arts and Sciences Electives	6
	15

SENIOR YEAR

1st Semester

Accelerated Block Semester:***

Rec. 332, Supervision in Recreation	3
Rec. 351, Outdoor Recreation	3
Rec. 352, Organization and Adm. of Recreation	3
Rec. 380, Internship	6
	15

2nd Semester

Rec. 390, Seminar	1
Arts and Sciences Electives	3
Free Electives	11
	15

*One of these five courses must be a "D" course.

**Select freely from anthropology, economics, geography, political science, more psychology, or more sociology. Economics 125 and Political Science 100 recommended.

***Prerequisite: 2.0 Cumulative Quality Point Average and senior standing as a major in Recreation. The first three courses are taught at double speed for half of the semester with final examinations by the end of the seventh week. Remainder of the semester, including Reading Days and Final Examination Period, is devoted solely to Internship. Because of the intensive nature of this plan, extended field tripping, probability that Internship may be a considerable distance from campus and demanding of irregular hours, students may not enroll in additional courses nor be employed regularly during this semester.

003, 004. FIELD EXPERIENCE.

Supervised experience as a volunteer, in leadership or other appropriate roles, in approved settings, for not less than twenty hours per semester. Enrollment limited to recreation majors. *Credit, 0.*

101. INTRODUCTION TO RECREATION.

Fundamental concepts, current status, and established principles of recreation as a social force. Field trip.

111, 112. PROGRAM ACTIVITIES I AND II.

Analysis of participant and activity characteristics; essential facilities, equipment, and supplies; specialized leadership techniques and fundamental program skills. 2 class hours, 4 laboratory hours, including field trips. Either course may be taken first.

131. ORGANIZED CAMPING.

Operating procedures of organized camps. Camper guidance, program skills, and practical leadership experience. Two-night camping trip, plus one-day trip. 2 class hours, 1 2-hour laboratory period.

230. GROUP LEADERSHIP.

Foundations and tools for leadership. Successful leadership techniques for large and small groups such as clubs and committees. Field trips. 2 class hours, 1 2-hour laboratory period.

313. LEISURE SERVICE PROGRAMMING.

Analysis of leisure service activities in terms of inherent characteristics and values for various participant types. Selection, planning, and development of appropriate comprehensive programs emphasized. Prerequisites, Rec. 111 and 112.

320. RECREATION FACILITIES.

Principles, practices, and problems in the planning, development, and management of recreation areas and structures in the facilitation of leisure programs and services. Prerequisites, Rec. 101, 111, and 112 or equivalent.

332. SUPERVISION IN RECREATION.

Nature, functions, principles and methods of supervision in recreation. The supervisory process as related to paid and volunteer staff. Prerequisite, Rec. 230 or equivalent.

351. INTRODUCTION TO OUTDOOR RECREATION.

Characteristics, principles, and practices of outdoor recreation, including current developments; relationship to other uses of land and water resources. Field trip costs approximately \$30. Taught jointly by the Departments of Recreation, Landscape Architecture, and Forestry and Wildlife Management.

352. ORGANIZATION AND ADMINISTRATION OF RECREATION.

Functions and methods for supervisors and assistant superintendents of various types of park and recreation agencies. Field trip costs approximately \$5.

353. ENVIRONMENTAL INTERPRETATION.

Principles and practices in interpretation for public appreciation of natural, archaeological and historical features in parks, museums and similar settings. Field trips cost approximately \$20. Prerequisites, 18 credits in one of the following areas: Anthropology, American History or the natural sciences; and permission of the instructor. 2 class hours, 1 2-hour laboratory period.

354. PERSPECTIVES IN THERAPEUTIC RECREATION.

Survey and analysis of recreation service and technique for the disadvantaged in varied settings. Staff relationships and future perspectives are emphasized. Field trips. Prerequisites, Zool. 135 or Phys. Ed. 141, 12 credits in pertinent psychology and/or sociology, Rec. 111 and 112; or permission of instructor.

361. INTRODUCTION TO OUTDOOR RECREATION.

Same course content as 351, but for nonrecreation block students. Field trip costs approximately \$30.

362. ORGANIZATION AND ADMINISTRATION OF RECREATION.

Same course content as 352, but for nonrecreation block students. Field trip costs approximately \$5.

380. INTERNSHIP.

Professional field experience with an approved cooperating recreation agency appropriate to the student's career choice. Open only to majors in the concentrated senior block. *Credit, 6.*

385, 386. SPECIAL PROBLEMS.

Individual intensive study of an aspect of recreation and the presentation of results in written form. *Credit, 2-3.*

390. SEMINAR.

Critical consideration of basic philosophies and problems in recreation. Prerequisite, Rec. 101 or 351. *Credit, 1.*

Department of Athletics

W. P. McGuirk, Athletic Director; R. W. O'Connell, Assistant Athletic Director; G. Ariel, Assistant Track Coach; A. Barber, Junior Varsity Baseball

Coach; H. Barr, Varsity Wrestling Coach; R. Bergquist, Varsity Baseball Coach; J. Berryman, Varsity Soccer Coach; M. Brosky, Junior Varsity Wrestling Coach; J. Canniff, Varsity Hockey Coach; K. Conatser, Assistant Football Coach; M. Faherty, Crew Coach; M. Fidler, Assistant Director of Intramural Athletics; G. Flood, Assistant Football Coach; V. Fusia, Staff Associate; R. Garber, Varsity Lacrosse Coach; R. Gaudette, Varsity Golf Coach and Assistant Basketball Coach; P. Graham, Associate Director of Intramural Athletics; R. Harris, Assistant Football Coach; D. Jekanowski, Junior Varsity Soccer Coach; V. Keedy, Supervising Physiotherapist; R. Kidd, Junior Varsity Hockey Coach and Junior Varsity Lacrosse Coach;

E. Kjeldsen, Varsity Gymnastics Coach; S. Kosakowski, Varsity Tennis Coach and Director of Stockbridge Athletics; J. Laughnane, Athletic Trainer; J. Leaman, Varsity Basketball Coach; W. MacConnell, Ski Coach; R. MacPherson, Head Football Coach; W. Maxwell, Assistant Football Coach; W. Novak, Staff Assistant; K. O'Brien, Varsity Track and Cross Country Coach; R. Page, Director of Sports Information; L. Pasquale, Assistant Football Coach; R. Pickett, Assistant Football Coach; J. Rogers, Varsity Swimming Coach; A. Rufe, Financial Manager of Athletics; T. Schmitt, Director of Intramural Athletics; W. Smith, Athletic Trainer; R. Wilson, Assistant Basketball Coach.

Department of Public Health

Head of Department: Professor William A. Darity. Professors Berger, Gage, Peterson; Associate Professors Gross, Moustafa, Peters; Assistant Professors Chen, DiNardi, Read, Tuthill, Wisneski; Instructor Crowley; Lecturers Pomerantz, Reed, Stryker.

The curriculum in Public Health is designed to prepare qualified University applicants for health career opportunities or further study in environmental health sciences, community health and health education. The department also provides a course of study in Medical Technology. In addition, certain courses in environmental health, community health, and health education are available to students in other departments. Students are expected to follow the course sequence outlined below. A minimum of 32 major credits is required of all students for the Bachelor of Science Degree. Some credits from other University departments are included in these major credits.

ENVIRONMENTAL HEALTH

(Public Health Option I)

Designed to prepare for career opportunities or further study of environmental health sciences, requiring specific technical knowledge and competence.

FRESHMAN YEAR

<i>1st Semester</i>	<i>Credits</i>
Rhetoric 100 or 110*	3
Math. 153**	3
Chemistry 111	3
Zoology 101	3
Psychology 101 or Sociology 101*	3
<i>2nd Semester</i>	
Rhetoric 100 or 110*	3
Math. 154**	3

PUBLIC HEALTH

Chemistry 112	3
Zoology 230	3
Sociology 101 or Psychology 101*	3

*May be taken either semester.

**On basis of placement tests and interest in advanced science. If a language is elected, intermediate proficiency is required.

SOPHOMORE YEAR

<i>1st Semester</i>	<i>Credits</i>
Physics 141	4
Chemistry 127	4
Electives***	
<i>2nd Semester</i>	
Physics 142	4
Chemistry 160**	4
English 331	2
2 Electives***	6

***Electives chosen from Social and Behavioral Sciences (3 credits), Humanities (6 credits), and Rhetoric 140, 145, 160, 165 or 170 (3 credits).

**Chemistry 261, 263, 262, 264, may be elected if a more comprehensive organic chemistry sequence is desired.

JUNIOR YEAR

<i>1st Semester</i>	<i>Credits</i>
PH 362, Environmental Health Practices	3
PH 383, Introduction to Health Administration	4
Microbiology 250, General	4
PH 375, Public Health Statistics	3
PH 379, Basic Public Health Laboratory Procedures	3
<i>2nd Semester</i>	
Microbiology 289, Pathogenic	4
PH 380, Advanced Public Health Laboratory Procedures	3
PH 378, Principles of Epidemiology	3
Electives	3
Summer: PH 382, Field Training	3-10

SENIOR YEAR

<i>1st Semester</i>	<i>Credits</i>
PH 332, Introduction to Air Pollution	3
CE 271, Introduction to Environmental Pollution Control	3
Chemistry 220, Biochemistry	4
or	
PH 385, Problems	3
Electives	6
<i>2nd Semester</i>	
PH 337, Introduction to Radiation Protection	3
PH 386, Problems	3
PH 331, Introduction to Occupational Health	3
Elective	3

COMMUNITY HEALTH AND HEALTH EDUCATION (Public Health Option II)

Designed to prepare for first level career opportunities or for further study in community health and health education requiring specific competence in community health analysis, program development and health education.

FRESHMAN YEAR

<i>1st Semester</i>	<i>Credits</i>
Rhetoric 100 or 110*	3
Math. 153**	3
Chemistry 111	3
Zoology 101	3
Psychology 101 or	
Sociology 101*	3
<i>2nd Semester</i>	
Rhetoric 100 or 110*	3
Math. 154**	3
Chemistry 112	3
Sociology 101 or	
Psychology 101*	3
Elective***	3

*May be taken either semester.

**On basis of placement tests and interest in advanced science.

***Elective chosen from Humanities. If a language is elected, intermediate proficiency is required.

SOPHOMORE YEAR

<i>1st Semester</i>	<i>Credits</i>
Physics 141*	4
4 Electives**	12
<i>2nd Semester</i>	
Zoology 230, Systems of the Human Body	4
Physics 142*	4
Microbiology 140	3
Electives**	3

JUNIOR YEAR

<i>1st Semester</i>	<i>Credits</i>
PH 383, Introduction to Health Administration	4
PH 301, Principles of Community Health Education	4
Statistics 121	3
Sociology Elective***	3
<i>2nd Semester</i>	
PH 304, School Health	3
Education Elective	3
PH 378, Principles of Epidemiology	3
PH 361, Principles of Environmental Health	3
2 Electives	6

SENIOR YEAR

<i>1st Semester</i>	<i>Credits</i>
PH 382, Field Training and Studies†	3-10
PH 385, Problems	3
and/or	
Electives**	3-7
<i>2nd Semester</i>	
PH 302, Community Development and Health Education or Elective††	3
PH 386, Problems	3
3 Electives**	9

*Students with departmental approval may take Physics 121 and Physics 122. However, they must take an additional public health course with a laboratory, for example, PH 379 or PH 389 or another course approved by the department.

**Elective chosen from Humanities, or Social and Behavioral Sciences or PH 301 or CE 374 or Rhetoric 140, 145, 160, 165, or 170. (3 credits)

***Students who take Statistics 231 and 232 instead of Math. 123 and 124 will not be required to take this course.

†This is an option based on student's future plans.

††This is an option based on student's interests.

NOTE

Recommended courses include: Sociology 261, Population; Political Science 220, Municipal Government; Political Science 100, American Government; Economics 125, Elementary Economics; Management 201, Principles of Management; Management 231, Administrative Theory (201 required as a prerequisite); Political Science 272, Public Administration; Sociology 292, Introduction to Social Welfare; Education 266, Preparation and Use of Visual Aids.

123 (I), (II). DYNAMICS OF PERSONAL AND COMMUNITY HEALTH.

Development of understanding and attitudes relative to personal, family and community health needs. Attention to mental and physical well-being, drugs, sexuality, communicable and chronic diseases and health services.

263 (I). INSTITUTIONAL HYGIENE AND SANITATION.

Application of bacteriology to the prevention of food poisoning events. Evaluation of sanitary measures designed to prevent disease transmission via food and institutional environments.

264 (II). MICROSCOPY OF WATER.

Microscopic forms of life, exclusive of bacteria. Counting and control of plankton in potable waters. Elements of limnology. Prerequisite, Microbiology 140. 3 class hours, 1 2-hour laboratory period.

301 (I). PRINCIPLES OF COMMUNITY HEALTH EDUCATION.

Principles of health education. Exploration of methods and approaches to community health. Family, school, and community dimensions and potentials. Types and use of various methods leading to community action. Permission of instructor. 3 class hours, 1 2-hour laboratory period. *Credit, 4.*

302 (II). COMMUNITY DEVELOPMENT AND HEALTH EDUCATION.

Latest approaches in community development and community organization procedures. Exploratory readings, field assignments, and leadership emphasis: stress on coordinated community action. Prerequisite, permission of instructor.

304 (II). SCHOOL HEALTH.

The principal concepts, methods, and dynamics of the organization of a school health program at the elemen-

tary and secondary level. Stress on planning and teaching in problem areas (i.e., sex education, mental health and drugs). Prerequisite, junior or senior standing or permission of instructor.

305 (I). CURRENT ISSUES IN HEALTH EDUCATION.

Latest issues in the field of health. Emphasis on controversial issues such as sex, drugs, and suicide education.

311 (II). HUMAN SEXUALITY AND SEX EDUCATION.

Human sexuality in relation to modern life. Emphasis on human sexuality as it may appear in the infant, the child, the adolescent, and the young married adult; examination and clarification of some of the crucial dynamics of the present era. Prerequisite, junior or senior standing and permission of instructor.

312. PUBLIC HEALTH AND FAMILY PLANNING. Public health problems associated with family health and population limitation. Historical factors, limitation methods, and barriers and facilitators related to family health and size. Prerequisites, PH 123, Soc. 101, or permission of instructor.

331 (I). INTRODUCTION TO OCCUPATIONAL HEALTH.

The relation of the occupational environment health, efficiency, and well-being of workers. Emphasis on industrial hygiene aspects of toxic materials and physical stresses. 2 class hours, 1 3-hour laboratory period.

332 (II). INTRODUCTION TO AIR POLLUTION. Effects of atmospheric air contamination on man and his environment. Nature and behavior of particulate and gaseous components of air, sources and control of pollutants, atmospheric sampling and analysis, biological effects, air quality standards. Prerequisites, Science, Engineering or Public Health majors, or permission of instructor.

337 (II). INTRODUCTION TO RADIATION PROTECTION.

Effect and control of radiation in the mammalian system. Includes sources, measurements, radio-sensitivity, radiation chemistry, cellular effects and acute and delayed effects in occupational, medical, and environmental exposures. Prerequisite, permission of instructor.

361 (II). PRINCIPLES OF ENVIRONMENTAL HEALTH.

The application of scientific knowledge to the control of the environment in relation to man's health and well-being. Air, water, waste disposal, food, housing, vector control, accidents, noise, ionizing radiation, and other physical and chemical stresses are considered. Prerequisites, introductory courses in biological or physical sciences and permission of instructor.

362 (I). ENVIRONMENTAL HEALTH PRACTICES.

The concepts of sciences and technology used by the environmental health practitioner in the control of man's environment. Designed primarily for environmental health and engineering majors. Water, wastewater, solid wastes, food, vector control, housing and accident control measures are considered. Prerequisite, permission of instructor.

PUBLIC HEALTH

372 (II). EPIDEMIOLOGICAL INVESTIGATION. A detailed examination of methods for the collection and use of mortality and morbidity data in epidemiological studies. Students will formulate and carry out a problem using each type of data. Prerequisites, PH 375 and PH 378. *Credit, 4.*

374 (II). CLINICAL BACTERIOLOGY.

Procedures in clinical laboratory work. Prerequisites, Microbiology 250 or permission of instructor. 1 class hour, 2 2-hour laboratory periods.

375 (I). PUBLIC HEALTH STATISTICS.

Principles of statistics applied to the evaluation of public health practices. Prerequisite, permission of instructor. 3 class hours, 1 2-hour laboratory period.

378 (I), (II). PRINCIPLES OF EPIDEMIOLOGY.

A basic course designed to develop an epidemiological perspective of health. Examined are general approaches for (1) describing the patterns of disease in groups of people and (2) elucidating the various processes involved in creating the differing levels of health in human groups. Lecture and laboratory examples illustrate a wide range of contemporary health problems.

379 (I). BASIC PUBLIC HEALTH LABORATORY.

Standard methods used in present day applied bacteriology; soils, dairy products, water and shellfish, and air. Prerequisites, Microbiology 140 or permission of instructor. 2 class hours, 2 2-hour laboratory periods.

380. ADVANCED PUBLIC HEALTH LABORATORY PROCEDURES.

Public health laboratory procedures; field collection of samples, stream pollution study, food poisoning and infection, standard methods of food analysis. Prerequisite, 379 or permission of instructor. 1 4-hour laboratory and 1 2-hour laboratory period.

382 (I), (II). SUPERVISED FIELD TRAINING.

A field training program with an official health agency, approved by the department. Must be under faculty supervision. *Credit, 3-10.*

383 (I). INTRODUCTION TO HEALTH ADMINISTRATION.

Introduction to the philosophy, nature, and scope of modern health services. Discussion of major health issues and programs. Organization of health services by local, national, and international health agencies. Prerequisites, Soc. 101 and Zool. 101, or permission of instructor. 3 class hours, 1 2-hour laboratory period.

Credit, 4.

384 (II). ORGANIZATION AND MANAGEMENT OF COMMUNITY HEALTH PROGRAMS.

The organization of health programs to meet the needs of the people. Emerging health problems and approaches to solving these problems. Emphasis on comprehensive planning and evaluation procedures. Prerequisite, PH 383 or permission of instructor. 3 class hours, 1 2-hour laboratory period. *Credit, 4.*

385, 386. SPECIAL PROBLEMS.

Individual study of a selected problem for qualified students. By arrangement with members of the department. *Credit, 1-3.*

390 (I), (II). SEMINAR.

Credit, 1-3.

MEDICAL TECHNOLOGY

There are two courses of study which a Medical Technology major may option in pursuit of a Bachelor of Science degree. Students electing Option I are required by the affiliated hospital schools of Medical Technology to have maintained averages of "C" or better in their science and mathematics courses. These students must have earned a total of 90 academic credits and satisfied the departmental and University curriculum requirements before beginning their hospital internships. Transfer students must in most cases, elect Option II.

OPTION I.

This curriculum consists of a three-year academic program followed by a 12-month internship in an accredited school of Medical Technology affiliated with the University. After successful completion of the 12-month internship and after satisfying the requirements of the department, a student will receive a Bachelor of Science degree in Medical Technology. A total of 130 academic credits is necessary for graduation with this option. Forty academic credits are earned during the fourth year, upon successful completion of the internship.

FRESHMAN YEAR

<i>1st Semester</i>	<i>Credits</i>
Rhetoric 100 or 110	3
Mathematics 123	3
Zoology 101	3
Chemistry 111, General	3
Social Science or Foreign Language	3
Physical Education	1

<i>2nd Semester</i>	
Rhetoric	3
Zoology 145, Human Genetics	3
Chemistry 112, General	3
Social Science or Foreign Language	3
Physical Education	1
Medical Technology 101	3

SOPHOMORE YEAR

<i>1st Semester</i>	<i>Credits</i>
Humanities Elective	3
Chemistry 261, 263, Organic	4
Zoology 223, Histology	3
Physics 121 or 141	3 or 4
Elective (Humanities or Social Science)	3

<i>2nd Semester</i>	
Humanities Elective	3
Chemistry 262, 264, Organic	4
Zoology 230, Anatomy and Physiology	4
Physics 122 or 142	3 or 4
Elective (Humanities or Social Science)	3

JUNIOR YEAR

<i>1st Semester</i>	<i>Credits</i>
Chemistry 220, Elementary Biochemistry	4
Microbiology 250, General	4
Elective	3
Statistics 315	3

2nd Semester

Chemistry 127, Analytical	4
Microbiology 280, Pathogenic	4
MT 390, Seminar	1
Electives	6

SENIOR YEAR

During the fourth year, students serve a 12-month internship in a hospital laboratory accredited by the Council on Medical Education of the American Medical Association and the Board of Schools of Medical Technology of the American Society of Clinical Pathologists and one with which the University of Massachusetts has reciprocal affiliation. If placement opportunities are limited, preference will be given to those students with superior overall records. The student must complete all of the requirements set by the American Society of Clinical Pathologists to qualify for the Registry of Medical Technology. The student who begins a hospital internship for credit toward a degree must complete the full year of hospital training in order to be granted any credit. The course of training must be consistent at all times with the curriculum formulated by the Board of Schools of Medical Technology as approved by the American Society of Clinical Pathologists, the College of American Pathologists, the American Society of Medical Technologists, and the Council on Medical Education and Hospitals of the American Medical Association.

The curriculum offered by the hospital staff of the accredited affiliated hospital shall have the following schedule:

<i>Course No.</i>	<i>Title</i>	<i>Minimum Lecture Hours</i>	<i>Credits</i>
MT 301	Clinical Microbiology	24	10
MT 302	Clinical Biochemistry	24	10
MT 303	Urinalysis	8	3
MT 304	Hematology	20	10
MT 305	Immunohematology	16	4
MT 306	Histology	8	3

In addition to clinical instruction within the hospitals, all the interning medical technology seniors meet regularly for didactic lectures given by the combined staffs of the hospitals and the University.

The hospital internship consists of 50 weeks at 40 hours per week, or 2,000 hours.

OPTION II.

This is a four-year academic program leading to a Bachelor of Science degree. Following graduation, the student will be assisted in arranging for a 12-month internship in an accredited school of Medical Technology. The student must complete all of the requirements established by the American Society of Clinical Pathologists to qualify for the Registry of Medical Technology. A total of 120 academic credits is necessary for graduation with this Option.

Students electing Option II should follow Option I program for Freshman, Sophomore and Junior years.

SENIOR YEAR

1st Semester

Courses to be advised.
Electives to complete University graduation requirements.

2nd Semester

Courses to be advised.

101 (II). INTRODUCTION TO MEDICAL TECHNOLOGY.

Basic clinical laboratory procedures and professional aspects of Medical Technology. Discussions, demonstrations, field trips, visiting lecturers and selected readings. 2 2-hour lectures, 1 2-hour laboratory period.

301. CLINICAL MICROBIOLOGY.*

Lectures and supervised training in the areas of bacteriology, parasitology, virology and mycology, emphasizing methods for isolating and identifying specific disease-causing organisms. *Credit, 10.*

302. CLINICAL BIOCHEMISTRY.*

Lectures and supervised training in the analytical methods useful in the diagnosis of diseased states characterized by various abnormalities in the body chemistry. Emphasis on method development, quality control, and clinical interpretation. *Credit, 10.*

303. URINALYSIS.*

Lectures and supervised training in the chemical and microscopic methods used in the diagnosis of renal disease and other metabolic disorders.

304. CLINICAL HEMATOLOGY.*

Lectures and supervised training in the principles of normal and abnormal blood cell production and the methods used in the diagnosis of specific blood diseases. *Credit, 10.*

305. IMMUNOHEMATOLOGY.*

Lectures and supervised training in the principles of blood banking and serology, emphasizing the genetic and immunologic qualities of the blood itself, the blood group systems, compatibility testing, and antibody detection. *Credit, 4.*

306. CLINICAL HISTOLOGY.*

Lectures and supervised training in the preparation of human tissues and organs for gross and microscopic examination as practiced in the hospital histopathology laboratory.

385, 386. SPECIAL PROBLEMS.

Individual study of a selected problem for qualified students. By arrangement with members of the department. *Credit, 1-3.*

390. MEDICAL TECHNOLOGY SEMINAR.

Open to Medical Technology majors only; permission of instructor required. *Credit, 1.*

*Course given in affiliated hospital schools of Medical Technology during the year of clinical internship.

SPECIAL PROGRAMS —

Computer and Information Science Program

Chairman of Program: Professor Michael A. Arbib. Professors Foster (Associate Director, University Computer Center) Kilmer, Lee, Wogrin (Director, University Computing Center); Assistant Professors Eckhouse, Jr., Riseman, Stidham, Taylor. Associated Faculty: Anderson (Education), Archer (Civil Engineering), Bobrow (Electrical Engineering), Ehrich (Electrical Engineering), Glorioso (Electrical Engineering), Lee (Electrical Engineering), Randall (Mathematics), Stockton (Civil Engineering).

121 (I), (II). BASIC.

An introduction to the programming of digital computers. Topics include: an introduction to the UMASS time-sharing system, the fundamental programming language BASIC, and the logic and techniques of programming. First third of semester. Laboratory required. *Credit, 1.*

122 (I), (II). FORTRAN IV.

A full study of the programming language FORTRAN IV on both the time-sharing system and the batch processing system. Laboratory required.

131 (I), (II). INTRODUCTION TO COMPUTERS AND PROGRAMMING.

Survey course covering: Brief history of computing machinery, an elementary description of computer hardware and peripheral equipment, machine language, machine organization and logical design. Prerequisites, COINS 121 or 122. Last two-thirds of semester. Laboratory required. *Credit, 2.*

132 (I). SURVEY OF COMPUTER APPLICATIONS.

A survey of digital computer problems with emphasis on the efficiency of programming. Uses APL as major programming language. Prerequisites, COINS 121 or 122 or permission of instructor.

133 (II). SURVEY OF COMPUTER APPLICATIONS.

A survey of digital computer problems with emphasis on the efficiency of programming. Uses FORTRAN as major programming language. Prerequisites, COINS 121 or 122 or permission of instructor.

210 (II). TRANSLATOR DESIGN.

The technique of language definitions, translation with particular reference to symbolic assemblers and algebraic compilers. Prerequisites, COINS 211, 223.

211 (I). SYNTACTIC ANALYSIS.

An introduction to the concepts and techniques of syntactical analysis with respect to context free grammars, the recognitive processes involved in the analysis and generative algorithms of computer translators. Consideration of precedence grammars and semantical implications of grammars. Prerequisite, COINS 122; Corequisite, COINS 270.

223 (I). MACHINE AND ASSEMBLY LANGUAGE.

A description with substantial examples and exercises of the structure of a large scale computer; its operating systems and language leading to studies of assembly and macro language capabilities. Prerequisites, COINS 131 and 132. Laboratory required.

224 (I). ADVANCED PROGRAMMING.

Use of list processing and associative type computers. Design of interpreters for these machines and assembly language programming. Design of higher level languages for them. Prerequisites, COINS 223, 235.

225 (II). SIMULATION LANGUAGES.

Discussion and use of discrete and continuous simulation languages. SIMSCRIPT, 1.5, GASP, GPSS, CSMP, CPM, DYNAMO, CSSL. Prerequisites, COINS 250 or 224.

233 (I). MINICOMPUTERS.

The use and programming of a small scale digital computer for data gathering, analysis and on-line control of experiments. Interfacing computers and experiments. Logical design of I/O. Prerequisite, COINS 131.

235 (II). COMPUTER ARCHITECTURE.

The various design concepts of computers; the historical influence of certain computer designers. Prerequisites, COINS 223, EE 210.

240 (II). INTRODUCTION TO AUTOMATA THEORY.

Basic notions of finite automata and Turing machines; finite-state acceptors and regular sets; equivalence relations and system identification; linear sequential circuits; complexity results for finite networks; elementary notions of recursive and recursively enumerable sets. Prerequisites, COINS 270 or Math. 212.

250 (I). COMPUTATIONAL MODELLING.

An introduction to probabilistic techniques as Markov process, Random Walk and Monte Carlo techniques. Statistical techniques, distributions, curve fitting by least squares, correlation coefficients, the method of Chi-square and variances. Selected operations research models such as simple queues, sequencing and n-person zero sum games. Selected topics generated by class interest from various areas of application. Prerequisite, COINS 132.

251. NUMERICAL METHODS IN SCIENCE AND ENGINEERING.

Same as Engineering 251.

252 (II). TOPICS IN NUMERICAL METHODS.

Computer oriented course in numerical analysis including linear algebra, solution of simultaneous equations, homogeneous equations, eigenvalues, solution of differential equations, solution of algebraic and transcendental equations and functional representations. Prerequisites, COINS 121, 131 or equivalent.

260 (II). LINGUISTICS AND AUTOMATA.

An introduction to formal language theory in relation to linguistic and psychological studies of the origins, properties and structure of natural languages; phrase structure and transformational grammars; pushdown,

linear-bounded and stack automata; applications of grammatical descriptions in behavior and pattern description. Prerequisites, COINS 211, 270.

270 (I), (II). FUNDAMENTALS OF COMPUTATION THEORY.

Introduction to basic concepts of automata, coding and switching theory and data structures. Emphasis on the underlying algebraic concepts of sets, relations, graphs, semigroups, groups, rings, fields, lattices and trees. Prerequisite, Math. 200.

275 (I). COMBINATORIAL THEORY AND ITS APPLICATIONS.

Solution of problems of enumeration using permutations and combinations, generating functions and recurrence relations. Introduction to graph theory, linear and dynamic programming. Block designs, difference sets and orthogonal Latin squares. Applications. Prerequisites, COINS 270 or Math. 212.

285 (I). CYBERNETICS AND THE BRAIN.

Information processing in the brain; parallel processing in hierarchically structured systems; feedback and pattern recognition; perception, memory and control of movement; layered somatotopically structured networks and their embryological development.

290 (I). ECOLOGICAL CYBERNETICS.

Introduction to the use of cybernetic methods to model ecological systems; first order systems of linear and nonlinear difference and differential equations; stability and oscillations in population interactions for n-species ecostructures; stochastic and computer simulation methods of studying population dynamics. Prerequisite, calculus.

294 (II). COMPUTERS AND SOCIETY.

The use of computers to solve social problems, and the studies required to avoid "side effects"; data banks; computerized voting; automated health care; computer-aided instruction, etc.

295 (I), (II). SEMINAR ON IMPLICATIONS.

Interdepartmental studies of social and economic factors in relation to computer-based solution of large-scale problems. Topic varies from year to year. Prerequisite, permission of instructor. *Credit, 1-6.*

Orchard Hill Interdisciplinary Program

(See Special Programs in front of this Bulletin)

201. (Phil. 343) INTERDISCIPLINARY APPROACH TO AESTHETICS (C).

An attempt to combine some studio work in the visual arts, music, and literature with general discussion of different philosophies of art.

202. BEYOND CORPORATE CAPITALISM (D).

Current problems of the American economy; analysis of the distribution of income and economic power. Attention to building the necessary conceptual and theoretical tools for analyzing capitalism. Prerequisites, Econ. 125-126 or permission of instructor.

205. RADICAL PSYCHOLOGY (D).

The works of selected modern psychologists, with emphasis on the radical nature of their work and its implication for health in Western society. Prerequisite, permission of instructor.

267. BIOLOGY AND THE MODERN WORLD.

Examines some major areas of development in the life sciences during the last century, and their social and philosophical impact, especially on questions of the origin of man, religion and evolution, eugenics and race.

269. HUMAN SEXUALITY.

Provides an experimental learning situation in self-awareness, human sexuality, group interaction, and patterns development. The person will serve as basic content for the course; ways to reach out toward other human beings will be fostered. Prerequisite, permission of instructor.

A86. (Psych. A92) INTERPERSONAL AND SOCIAL PERCEPTIONS.

Covers a number of systematic positions which attempt to explain exactly how people perceive motive, causes, purposes, and enduring characteristics in themselves, others, and the environment in general.

B86. THE AMERICAN POLITICAL ECONOMY.

Examines political power in the United States, and attempts to bring it out of the abstract and into the real world.

D86. TUTORIAL PROJECT.

In cooperation with the Holyoke Street School, an "alternative" school recently established in Holyoke, Mass. Training sessions, led by recognized experts; tutorial experience in Holyoke, and community relations work in the School (which sees itself more as a community center than simply a "school"). Prerequisite, permission of instructor.

388. PHOTOGRAPHY AND AESTHETICS.

An introduction to basic techniques of photography and an understanding of the creative processes with respect to the visual media.

389. PROPAGANDA AND THE REPORTER.

How public opinion is formed; it will look into stereotypes and images that form elements of propaganda; the credibility of the reporter.

390. RESIDENTIAL COLLEGE AND HIGHER EDUCATION.

The crisis in American education, its relation to American society and viable alternatives to the self-perpetuating nature of both, especially the alternatives presented by residential colleges here and elsewhere.

391. NON-WESTERN ART.

Non-Western art in its relation to the culture producing it and the religions, myths, and social structures it reflects. Relates each quality discussed in Non-Western art to some aspect of Western life.

392. THE BIBLE AND MYTH.

The Hebrew myths of the Old Testament and the Christian myths of the New Testament against the background of Mesopotamian and Greek pagan myths.

393. GURU, ROSHI, TZADIK AND SHRINK.

The life-styles of particular "Masters" of a recognized tradition, whether religious, artistic, or psychological. Various methods, disciplines and styles of interaction for evoking awakening or creativity will be compared. Prerequisite, permission of instructor.

394. JAZZ SURVEY.

The history of jazz, from its African origins to the present. Emphasis on recognizing styles and understanding their development.

395. CURRENT ISSUES IN AMERICAN INDIAN COMMUNITIES.

Examines two sets of issues: The role of the federal government in terms of social agencies and the changing role of various Indian communities in terms of self-determination, and economic disfunction in Indian communities (suicide and alcoholism as outward manifestations of cultural values).

396. MODES OF FILM COMMUNICATION.

Aspects of film which make it a unique medium; the basic types of film (documentary, narrative, experimental, etc.). Brief reviews of film history and technology.

397. ARTS AND SOCIETY: EAST GERMANY, 1949-PRESENT.

Development of the Arts, particularly literature, in this socialist country since the founding of the GDR. The relationship between the socialist state and the writer, painter, and sculptor.

Marine Sciences Program

Acting Chairman of Program: Arthur C. Gentile (Associate Dean of the Graduate School). Professors Yentsch (Director, Marine Station), Carritt; Assistant Professor Klapow. *Associated Faculty:* Commonwealth Professor Litsky (Environmental Microbiology), Professor Heronemus (Civil Engineering), Associate Professors Cole (Fisheries Biology), Hayes (Geology), Webb (Geology), Wilce (Botany); Assistant Professors Edwards (Zoology), Levin (Food Science and Technology). The Marine Sciences Program is an interdisciplinary program administered by the Graduate School. While there is no undergraduate major in Marine Sciences, several general interest courses are offered to undergraduates. These courses will benefit the student who desires a general understanding of the marine environment as well as the student who plans to seek an advanced degree in either marine biology or oceanography. Further information can be obtained from Dr. Lawrence A. Klapow, Marine Sciences (c/o Botany) Morrill Science Center, or Dr. Charles F. Cole, Fisheries Biology, Holdsworth Hall, University of Massachusetts, Amherst, MA 01002.

Courses Open to Undergraduates:

Geol. 355. PHYSICAL OCEANOGRAPHY.

Physical properties of sea water and their variations; water masses and circulation; interactions between ocean and atmosphere; wave, tide and current dynam-

ics; techniques of oceanographic study. Prerequisites, one year of college physics; calculus recommended.

Mr. Hayes.

MS 201. BIOLOGICAL OCEANOGRAPHY.

Aspects of major planktonic and benthic marine taxa, including distribution, periodicity, and dominant ecological factors. Staff.

MS 225. INTRODUCTORY OCEANOGRAPHY.

A survey of oceans and sea water, the substrate, marine life, and processes; oceanographic techniques. For students in engineering and others desiring a general knowledge of the sea. Prerequisites, one year each of college level physics, chemistry, and mathematics. Staff.

Division of Military and Air Science

Military Science

Head of Department: Professor (Colonel, USA) George I. Connolly, Jr. Assistant Professors (Major) Faison, (Captain) Libby; Lecturer (Major) Best

Students electing Military Science must complete 12 Military Science credits, 8 academic credits in other departments and a six-week summer camp session at the end of the junior or senior year. The summer session permits the practical application of theory presented in academic subjects and also includes subjects which can best be instructed under field conditions. Upon completion of University degree requirements and departmental requirements, the student is commissioned a Second Lieutenant in the US Army. Students also participate in department-sponsored orientation visits, field trips and off-campus exercises.

FRESHMAN YEAR

<i>1st Semester</i>	<i>Credits</i>
MS 111, History of the Military Art I	1
<i>2nd Semester</i>	
MS 112, History of the Military Art II	1

SOPHOMORE YEAR

<i>1st Semester</i>	
MS 125, Introduction to Contemporary Military Theory and Art	1
<i>2nd Semester</i>	
MS 126, U.S. Defense Establishment	1

JUNIOR YEAR

<i>1st Semester</i>	
MS 251, Military Leadership and Management I	2
<i>2nd Semester</i>	
MS 252, Contemporary Military Theory and Art I	2
Summer Session (6 weeks)	

SENIOR YEAR

<i>1st Semester</i>	
MS 375, Military Leadership and Management II	2
<i>2nd Semester</i>	
MS 376, Contemporary Military Theory and Art II	2
<i>1st Semester</i>	
MS 377, Army Flight Instruction Program	3

1st Semester

MS 385, Special Problems	1 or 2
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2nd Semester

MS 386, Special Problems	1 or 2
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111 (I). HISTORY OF THE MILITARY ART I. American Military History from the Revolutionary War to World War II with emphasis on the social, economic and political factors which have caused participation in each war; Army organization of each war and post-war period; leadership techniques in the application of the principles of war; the development of tactics weapons and equipment; leadership fundamentals. 1 class hour, 1 laboratory period, \$2 lab fee. *Credit, 1.*

112 (II). HISTORY OF THE MILITARY ART II. American Military History from World War II to Vietnam with emphasis on topics listed for MS 111; leadership fundamentals. Prerequisite, MS 111 or permission of instructor. 1 class hour, 1 laboratory period. \$2 lab fee. *Credit, 1.*

125 (I). INTRODUCTION TO CONTEMPORARY MILITARY THEORY AND ART.

Introduction to principles and fundamentals of contemporary military tactics, map reading and navigation principles are applied in classroom case studies and exercises; continuation of leadership fundamentals. Prerequisite, MS 112 or permission of instructor. 2 class hours, 1 laboratory period, \$2 lab fee. *Credit, 1.*

126 (II). U.S. DEFENSE ESTABLISHMENT.

Introduction to national defense organization; Army branches and their missions; Army role in the support of national policies and evolution of U.S. Military Policy; continuation of leadership fundamentals. Prerequisite, MS 125 or permission of instructor. 2 class hours, 1 laboratory period. \$2 lab fee. *Credit, 1.*

251 (I). MILITARY LEADERSHIP AND MANAGEMENT I.

Theory of Military Leadership and Management with application in case studies and leadership laboratory; military, instructional principles and practicum. Prerequisite, MS 126 or permission of instructor. 3 class hours, 1 laboratory period. \$2 lab fee. *Credit, 2.*

252 (II). CONTEMPORARY MILITARY THEORY AND ART I.

Principles of offensive and defensive combat and leadership applications in units of the infantry division; military communications management; contemporary

concepts and techniques in counterinsurgency operations. Prerequisite, MS 251 or permission of instructor. 3 class hours, 1 laboratory period. \$2 lab fee. *Credit, 2.*

375 (I). MILITARY LEADERSHIP AND MANAGEMENT II.

Introduction to Military Law; survey of Army administrative procedures and logistical management; examination of internal defense development and the military implications of world change. Prerequisite, MS 252 or permission of instructor. 3 class hours, 1 laboratory period. \$2 lab fee. *Credit, 2.*

376 (II). CONTEMPORARY MILITARY THEORY AND ART II.

Command and staff organization and operations including information sources and decision-making; organization and employment of the combined Arms team. Prerequisite, MS 375 or permission of instructor. 3 class hours, 1 laboratory period. \$2 lab fee. *Credit, 2.*

377 (I). ARMY FLIGHT INSTRUCTION.

Flight instruction is offered to eligible seniors who opt to serve as pilots in the U.S. Army. Students receive 35 hours of classroom instruction in meteorology, navigation and Federal Aviation Regulations and 36½ hours of flight instruction at a Federal Aviation approved facility. Upon successful completion of the course and FAA examination students receive a private pilot's license. Prerequisites, MS 252 and permission of the Professor of Military Science. 2 class hours, 2 laboratory periods.

385, 386. SPECIAL PROBLEMS.

Individual study of a selected problem for qualified students. By arrangement with staff. *Credit, 1-3.*

Air Science

Head of Department: Professor (Colonel) Fisher.
Assistant Professors (Lt. Col.) Hayes, (Captain) Duto.

SOPHOMORE YEAR		
<i>1st Semester</i>		<i>Credits</i>
AS 121, Defense Organization	1	
<i>2nd Semester</i>		
AS 122, Defense Policies and the Military	1	
JUNIOR YEAR		
<i>1st Semester</i>		
AS 231, Growth and Development of Aerospace Power I	3	
<i>2nd Semester</i>		
AS 232, Growth and Development of Aerospace Power II	3	
AS 233, Flight Instruction Program—Classroom Phase	2	
SENIOR YEAR		
<i>1st Semester</i>		
AS 341, The Professional Officer I	3	
AS 343, Flight Instruction Program—Flight Phase	1	
<i>2nd Semester</i>		
AS 342, The Professional Officer II	3	
AS 343, Flight Instruction Program—Flight Phase	1	

AIR SCIENCE

111 (I). THE U.S. AIR FORCE.
Introductory examination of the mission, organizational structure, and operational concepts of the U.S. Air Force with emphasis on U.S. strategic offensive and defensive forces. 1 class hour, 1 hour of corps training. *Credit, 1.*

112 (II). U.S. MILITARY FORCES.
Missile defense, U.S. general purpose forces, and Air Force support forces. The mission, resources, and operation of tactical air forces in limited war. Review of Army, Navy, and Marine general purpose forces, their concepts and organization. 1 class hour, 1 hour of corps training. *Credit, 1.*

121 (I). DEFENSE ORGANIZATION.
The U.S. Department of Defense, the role of the military as an element of national power, and the nature and principles of war. 1 class hour, 1 hour of corps training. *Credit, 1.*

122 (II). DEFENSE POLICIES AND THE MILITARY.
The defense policies of the Soviet Union and China, the role of alliance in U.S. defense policy, and the making of U.S. defense policies. 1 class hour, 1 hour of corps training. *Credit, 1.*

231 (I). GROWTH AND DEVELOPMENT OF AEROSPACE POWER I.
The development of aerospace power into a prime national security element, the development of doctrinal thought that concerns aerospace forces, and the role of technology in this growth and development. Presented in a general historical development from the beginning of manned flight to present. 3 class hours, 1 hour of corps training.

232 (II). GROWTH AND DEVELOPMENT OF AEROSPACE POWER II.
Future aeronautical equipment, astronautics, and space operations; future manned aircraft, space vehicles and systems; problems in space exploration, and future space programs. 3 class hours, 1 hour of corps training.

233 (II). FLIGHT INSTRUCTION PROGRAM CLASSROOM PHASE.
Aeronautics primarily for those students eligible for and who elect to serve as pilots in the United States Air Force. 2 class hours. Permission of department required. *Credit, 2.*

341 (I). THE PROFESSIONAL OFFICER I.
Military management functions, the role of command and staff in decision-making, and the factors relating to effective leadership. 3 class hours, 1 hour of corps training.

342 (II). THE PROFESSIONAL OFFICER II.
The professional concept of military duty, and the framework of military law. 3 class hours, 1 hour of corps training.

343 (I), (II). FLIGHT INSTRUCTION PROGRAM—FLIGHT PHASE.
Aeronautics for those eligible students electing to serve as pilots in the United States Air Force. Provides a total of 36½ hours of flight instruction. Prerequisite, Air Science 233. By arrangement. *Credit, 1.*

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University of Massachusetts at Amherst

CAMPUS ENROLLMENT, SEPTEMBER 1971 FOUR YEAR — UNDERGRADUATE

	1972		1973		1974		1975		Totals	
	Men	Women	Men	Women	Men	Women	Men	Women	Men	Women
Agriculture	229	27	392	55	199	33	233	51	1053	166
Arts and Sciences	1004	703	1500	967	1251	930	1364	1062	5119	3662
Business Administration	368	13	352	21	290	20	255	15	1265	69
Education	69	362	103	370	49	249	31	188	252	1169
Engineering	195	1	287	4	208	8	272	10	962	23
Home Economics	3	147	13	291	5	205	—	104	21	747
Nursing	1	67	3	117	2	111	1	117	7	412
Physical Education	118	89	176	74	123	77	92	72	509	312
Public Health	9	26	18	45	15	20	13	34	55	125
Other	21	14	36	20	5	2	1	—	63	36
Total	2017	1449	2880	1964	2147	1655	2262	1653	9306	6721
Total by Class	3466		4844		3802		3915		16,027	

Graduate School

Men	Women	Total
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3,718	1,849	5,567
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Summary

Undergraduate School	16,313
Stockbridge School	625
Graduate School	5,567

TOTAL AMHERST

22,505

Boston Campus

4,869

Medical School

40

TOTAL UNIVERSITY

27,414

Source: Office of Institutional Studies

Stockbridge School

	Men	Women	Total
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1972	241	36	277
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1973	299	36	335
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Special	9	4	13
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*1972-1973
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Academic Calendar (1972-1973)

FIRST SEMESTER

Sept.	5-8	Tues.-Fri.	Freshman Orientation
Sept.	11	Mon.	Classes begin
Oct.	9	Mon.	Holiday
Oct.	23	Mon.	Holiday
Oct.	24	Tues.	Monday schedule
Oct.	30	Mon.	<i>Midsemester</i>
Nov.	22	Wed.	Thanksgiving Holiday begins after last class
Nov.	27	Mon.	Classes resume
Nov. 28-Dec. 8		Tues.-Fri.	Pre-Registration Period
Dec. 15-Jan. 2		Fri.-Tues.	Vacation begins after last class Friday
Jan.	3-8	Wed.-Mon.	Reading Period
Jan.	9-18	Tues.-Thurs.	Examination Period

SECOND SEMESTER

Jan.	25	Thurs.	Registration
Jan.	29	Mon.	Classes begin
Feb.	19	Mon.	Holiday
Feb.	20	Tues.	Monday schedule
Mar.	19	Mon.	<i>Midsemester</i>
Mar. 23-Apr. 2		Fri.-Mon.	Vacation begins after last class Friday
Apr.	16	Mon.	Holiday
Apr. 23-May 4		Mon.-Fri.	Pre-Registration Period
May	9-15	Wed.-Tues.	Reading Period
May	16-25	Wed.-Fri.	Examination Period
June	7	Thurs.	Commencement

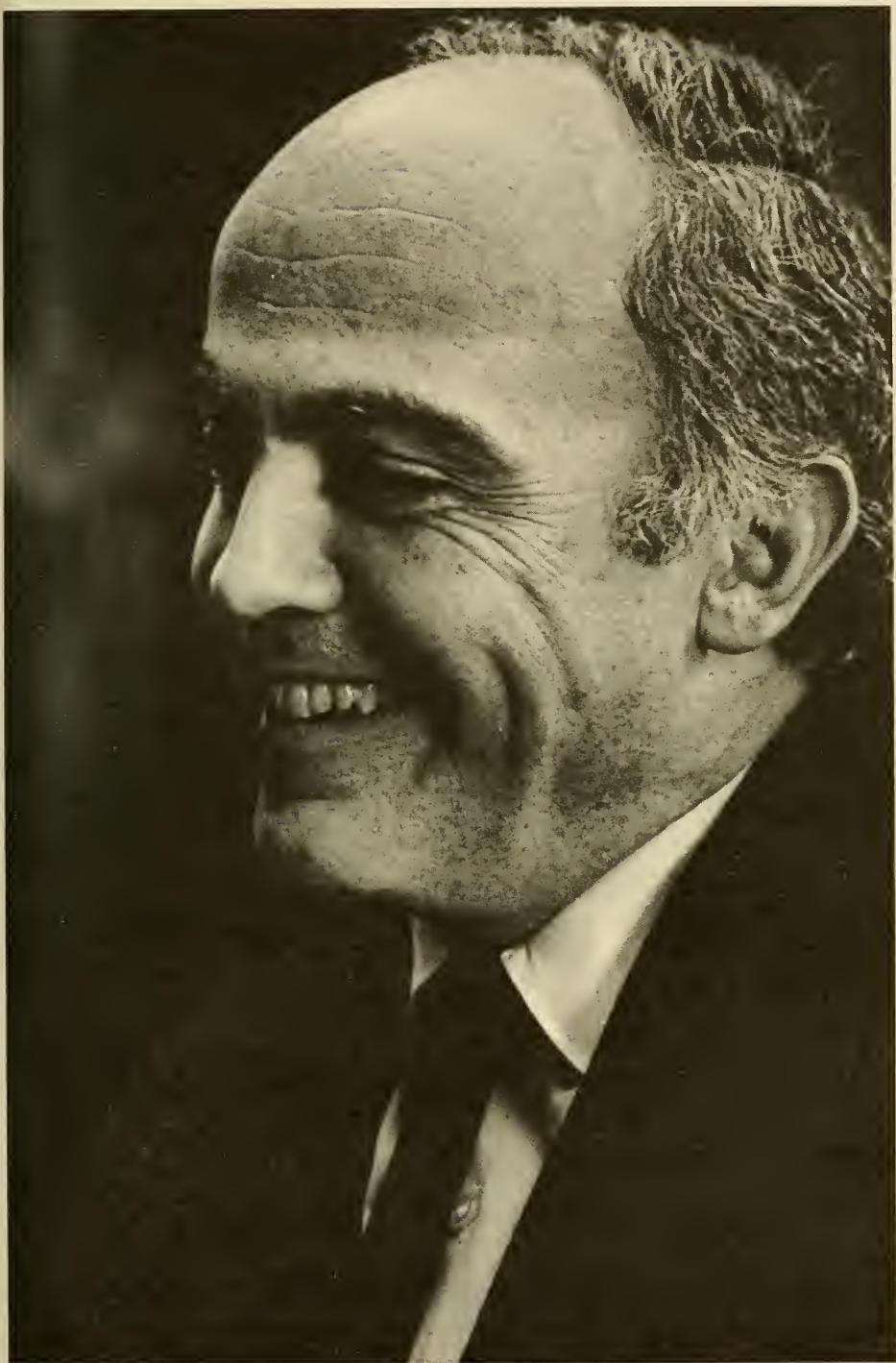
Message from the Chancellor

A university belongs at the intellectual center of the woes and the joys of a culture. See what is involved: the *intellectual* center, for as an institution, the university is not oriented to action but to equipping people for action; yet, just as certainly, the intellectual *center*, for the university's crucial tasks must not stray too far from the real concerns of the people it gathers and the people it serves. It has a duty to enlarge the range of those concerns, and to lead trained intelligence to dwell on them.

UMass/Boston, as an enterprise supported by all the people of the Commonwealth, has a special call. Its urban location gives it the flavor of the city. Its low tuition makes it accessible to many, perhaps eventually to all. Its students, most of whom work as well as attend college, have no residential dormitories to curtain them from the life of Greater Boston. Its faculty members select themselves in response to the character of the University.

Together we look for an institution that makes neither Alexandria nor Bologna nor Woodstock nor Hue alien to us. The ideal is never reached, but even the process of partial failure enriches the ideal.

FRANCIS L. BRODERICK



Foreword

The University of Massachusetts at Boston is a new urban state university founded to provide at low cost the educational opportunities and services needed by the people of Greater Boston. The first class was graduated in 1969. In 1971-72, 4600 students were enrolled. The University offers undergraduate programs in every area of the arts and sciences, and maintains a student faculty ratio of 15-1.

The University is at an interesting moment of change. This year, for the first time, all entering students will be assigned to one of two colleges. At the present time students will find few differences between them, and assignment to the colleges is on a random rather than a selective basis.

Both colleges are comprehensively liberal arts colleges that seek to perform the perennial tasks of Western universities: to preserve and transmit what is known, to inquire into what is unknown, and to educate a new generation for its own inquiries.

In seeking to graduate liberally educated men and women, the colleges encourage their students to seek mastery over language and to gain insight into the culture that languages express; to probe the value of formal thought; to learn more about animate and inanimate nature; to become more aware of the methods and results of disciplines that investigate man, his institutions, his culture, and his physical world; to test man's aspirations against his experience.

In addition to complete offerings in the arts and sciences, the campus offers a Teacher Certification Program that meets the state's standards, and a concentration in Afro-American Studies. New Master's programs in Chemistry and English have been approved.

The division of the University into the two colleges has been a recent one. As time passes, the Dean, faculty, and students of each of the two colleges will be developing the distinctive character of the school, especially in matters of curricula. Other colleges will be developed, bringing new programs into the curricula; ultimately six colleges are planned. While it is expected that the college to which a student has been assigned will ultimately become the source of most of his social and educational experiences, nothing in the current development would prevent a student from taking courses in a college to which he has not been formally assigned. In studying the offerings in this catalogue, you should keep in mind that it is not just the particular college but the university that offers you such a rich curriculum.

This University is a place of change, with major involvement by students and faculty in its governance.

Plans for the third college call for an academic program that both involves field experience in urban service agencies and leads to careers in public community service.

For the academic year, 1972-73, the University will be located at its present site in the Park Square area of Boston in some eleven buildings, all of which are close to MBTA, bus and train stations, and terminals. In the fall of 1973 the University of Massachusetts at Boston will be at its new campus in the Columbia Point section of Dorchester. The new campus will include science and library facilities, and each college will be located in its own building. Additional phases of the new campus will continue for several years, adding new facilities for the fully rounded educational development of men and women of Greater Boston.

The University of Massachusetts at Boston is part of the state-wide university system which includes the university campus at Amherst and the Medical School in Worcester. Each unit of the system abides by the policy that acceptance of students is based without regard to race, color, creed, sex, or national origin.



General Information

Major Degree Programs Available:

Anthropology	German	Politics
Art	Greek	Psychology
Biology	Italian	Russian
Chemistry	Latin	Sociology
Classics	Mathematics	Spanish
Economics	Music	Theatre Arts
English	Philosophy	
French	Physics	

Preparations are also available in Afro-American Studies, Humanities, Religious Studies, Social Sciences, as well as in Urban Social Service and Teacher Certification for the elementary and secondary schools. Advisors are available to those wishing to pursue Pre-Law, Pre-Medical, Pre-Dental, or Pre-Veterinary programs.

Library

The University Library book collection contains approximately 139,000 volumes. Over 2,500 domestic and foreign journals are received currently in the periodical room. The Main Library, housed in the former First Corps Cadet Armory, is a spacious building which provides room for housing books, seating students and conducting library operations. In addition, a science library, containing the collections in Biology, Chemistry, Mathematics, and Physics, is located in the University's main building.

The library is easily accessible from all of the University buildings and forms a natural nucleus in its present site. In the main reading room and the periodical room, individual carrels provide seating for 350 students. The library's resources support the teaching programs of the University on every level.

Language Laboratories

The language laboratories have the most modern electronic equipment available. With 71 student positions in three different laboratories, students have the opportunity of extended contact with the foreign language being studied. The tapes used in laboratory sessions are closely correlated with classroom studies, and the recordings made by students during laboratory sessions can be played on standard recorders at home for advanced, individual study in such fields as drama, literature and music.

Bookstore

Located on the first floor of the Sawyer Building, the Bookstore carries all textbooks required for courses plus a complete line of school supplies, candy, cigarettes and gift items. Also carried is an excellent selection of paperbacks and non-required hardbound books. Special orders can be made for almost any other book in print.

Bookstore hours are 9 a.m. to 4:45 p.m., Monday-Friday, when school is in session.

Admissions

APPLICATIONS

Applications for admission may be obtained from the Admissions Office, 44 Piedmont Street, Boston, Massachusetts 02116. Out-of-state and foreign applicants should return their completed forms *before* February 1. In-state freshman applications should be returned by March 1 for September admission and by November 1 for January admission, transfer applications by April 1 for September and November 1 for January. *No application fee is required.*

Applicants are invited to visit the campus where group meetings are held daily at 3 p.m. This is an appropriate time to tour the campus and ask questions. An applicant should be assured, however, that if he is unable to visit Boston his application will be in no way disadvantaged.

A personal conference may be scheduled if the University deems it necessary or if the candidate or his guidance counselor has a question that cannot readily be resolved otherwise.

TESTING PROCEDURE

All applicants must take the Scholastic Aptitude Test given by the College Entrance Examination Board. The University also recommends three College Board Achievement tests, including English Composition. All College Board Test reports must be sent directly to the Admissions Office, 100 Arlington Street, University of Massachusetts at Boston, Massachusetts 02116, from the College Board Testing Center. The applicant himself must notify the Board that he wishes his scores sent to this University. Applicants who have been out of school for more than two years should take the Scholastic Aptitude Tests again.

VETERANS

The University of Massachusetts at Boston seeks to serve Massachusetts veterans recently discharged from the Armed Services through evaluation based primarily on recent Scholastic Aptitude Test scores (no more than two years old) and increased level of maturity. The requirement of new SATs must be met.

FOREIGN AND OUT-OF-STATE STUDENTS

Since the University of Massachusetts at Boston has a five percent limit on out-of-state and foreign students, the competition among these candidates is always extremely keen.

All foreign students are required to submit results of Scholastic Aptitude Tests. In addition, students whose native language is not English should submit results of the Test of English as a Foreign Language. Information regarding test centers and dates for both the SAT and the TOEFL can be obtained from the College Entrance Examination Board, P.O. Box 592, Princeton, New Jersey 08540.

As a state university, the University of Massachusetts at Boston is unable to offer any form of financial aid to foreign students. Therefore, foreign students should make certain that they can meet all expenses before applying for admission.

HIGH SCHOOL PREPARATION

The subjects of preparatory study recommended for admission call for the satisfactory completion of a four-year high school course or its equivalent and are stated in terms of units. A unit is the equivalent of at least four recitations a week for a school year. High school graduation alone is not sufficient. The applicant's record must indicate capacity for handling the quality of scholastic work which the University has established as its standard of achievement. Sixteen units of secondary school work must be offered, selected according to the following recommendations:

College Preparatory Mathematics	3*
English	4
Foreign Language (2 years of 1 language)	2
U.S. History	1
Laboratory Science	1

The remaining units are elective and may be selected from the following subject matter:

- a. Mathematics
- b. Science
- c. Foreign Language
- d. History and Social Studies
- e. Free electives (not more than four units)

Free elective subjects are those not included in groups a-d, as for example: music, art, drawing, typewriting, aeronautics, agriculture, home economics, etc. Such free electives are allowed in order that the student who wishes may have some opportunity to elect other high school offerings, while at the same time covering the fundamental requirements for college work.

* Preferably two years of Algebra and one of Plane Geometry.

Students planning to major in the physical sciences and mathematics should, if possible, offer two years of algebra, one of plane geometry, and one-half year of trigonometry. Preparation in analytical or solid geometry, chemistry, physics, and introductory calculus is also strongly recommended.

Candidates of exceptional ability and promise may be considered for admission even though some of the prescribed courses are not included in their high school records. Candidates who are deficient in one or more subjects required for admission to the University must present records which are otherwise strong.

EQUIVALENCY DIPLOMA

In some cases the Massachusetts High School Equivalency Diploma may be substituted for the usual high school program. It is suggested that persons with an equivalency diploma arrange for a personal interview with a member of the admissions staff to discuss their goals and possible plans for meeting these goals.

ACKNOWLEDGEMENT AND NOTIFICATION

In most cases applicants will be notified by letter during April of the action taken on their applications for September and during December for January. Applicants who present strong academic records, enthusiastic school recommendations, and satisfactory College Board scores will receive earlier notification. This early notification should reassure the well-qualified applicant regarding college entrance and enable the student who has selected the University as his choice of college to settle his plans. Applicants accepted at an early date, however, are under no pressure to make a final decision in regard to their choice of college before the Candidate's Reply Date. In this way the burden of multiple applications on high school guidance counselors and college admissions officers may be lessened.

ADVANCED PLACEMENT

Students whose scores on Advanced Placement examinations meet standards determined by the University shall be regarded as meeting the equivalent University requirements. The College Entrance Examination Board Advanced Placement examinations or special examinations given by the University will determine advanced placement.

Students who wish to continue the study of a language in which they have had previous training are required to take an appropriate placement test. Placement tests are administered by the University prior to registration for the fall terms. Students will be placed at the level of study indicated by the results of the tests; the intermediate level requirement may be met by achieving an adequate score.

TRANSFER STUDENTS

A limited number of transfers from approved colleges may be admitted. Since applicants for transfer exceed the number that can be accepted, they are placed on a competitive basis. Evaluations will be based upon high school and college records and on the College Board Scholastic Aptitude Tests, which are required of all transfers. Any student who has been previously enrolled in a college is considered a transfer and must file a transfer application form. Applicants for transfer should write to the Admissions Office for a transfer application.

Any course taken at an accredited institution which is comparable in substance to a course offered at the University of Massachusetts at Boston, and in which the grade is C or better, will transfer and be applied, wherever possible, to the graduation requirements.

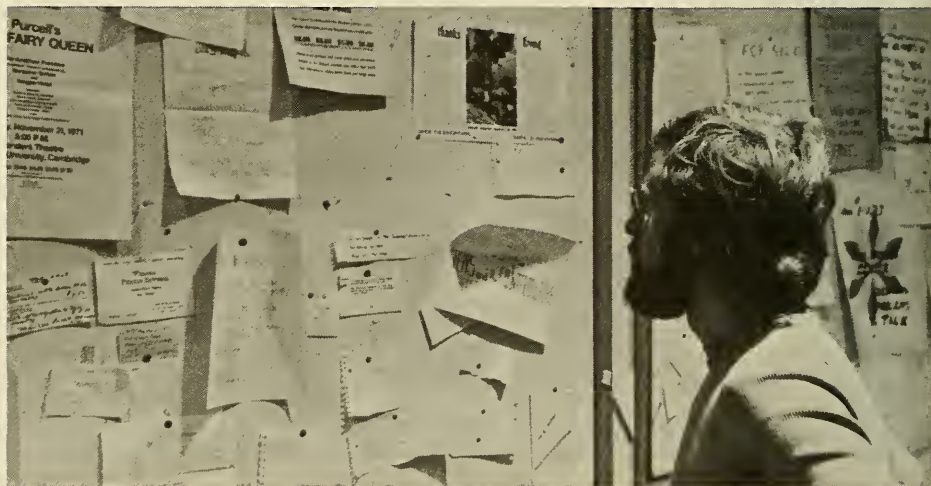
At least 30 semester hours must be earned at the Boston campus in order to graduate from this campus.

High school and all college transcripts plus results of Scholastic Aptitude Tests must be sent to the Admissions Office. Transfer application forms signed by the registrar of the last college attended must be submitted by November 1 for the spring semester and by April 1 for the fall semester.

All transfer students who are candidates for a Bachelor's Degree must take at least 45 semester credits in residence as well as fulfill all University requirements for graduation.

Community College Transfers

As a part of the Massachusetts system of higher education, the University recognizes its kinship with the regional Community Colleges and therefore guarantees that the student who has completed the Community College transfer program, who is fully qualified, and has the recommendation and required cumulative average of the Community College, will be accepted for transfer



into the four-year program. Appropriate courses given at the Community College will be fully accepted for transfer credit and applied to core curriculum requirements where possible.

Special Admissions

The Special Admissions Office seeks to attract students from minority group backgrounds and those who for financial reasons might not consider applying to college at all. Most of the students are older and have held jobs for several years. In order to apply, a student must be from a low income background. All students accepted by the Special Admissions Office are full-time degree candidates under the same obligations as all other students who come to the University.

Each student who applies through Special Admissions must submit, along with his application, two informative letters of recommendation from those familiar with his work, either on a job, in school, or in connection with a project he has pursued in the community; and a high school transcript. Students who have not completed high school are encouraged to consider applying, provided they have had an equivalent work experience or have read widely. After completion of the application, an interview should be arranged. The purpose of the interview is to give the counselor some idea of the applicant's interests, his hopes for the future, and his past experiences, in an effort to help both the counselor and the student decide whether or not the application to the University makes sense.

In the Spring, open meetings are held for prospective students to discuss Special Admissions and the University in general. Those students accepted for the fall semester are required to participate in a summer writing-skills program.

Further questions can be answered directly by the Special Admissions Office. All applications should be addressed to Mr. Livaughn Chapman, Director, Special Admissions, University of Massachusetts at Boston, 100 Arlington Street, Boston, Massachusetts 02116. Students should apply *no later* than June 30 to assure September consideration.

College Preparatory Program

The College Preparatory Program provides an opportunity for low-income high school students with inadequate academic backgrounds to prepare themselves for admission to the University. Ordinarily students enter during their sophomore or junior year of high school. Financial eligibility is set by the guidelines of Upward Bound, which provides most of the funds for the program. In general, students are accepted who show strong motivation and academic promise but have performed unevenly or have been enrolled in business or trade curricula in high school. Upon completion of their work in the program,

students are accepted for admission to the University of Massachusetts at Boston.

The program offers twice-weekly evening courses in standard college preparatory subjects and provides tutors in courses taken in the student's high school. During the senior year, qualified students may enroll for credit in a freshman level University course with tutorial support. In the summers following the sophomore and junior years, students attend a six-week residential summer school outside Boston. During the summer following graduation from high school, students attend a summer session at the University in which they are enrolled in freshman courses with tutorial support.

Application forms and further information may be obtained from the Director, College Preparatory Program at 542-6815.

Classification of Students

I. DEGREE STUDENTS

Full-Time Students: All students carrying 12 or more credits are accepted as degree candidates and assigned to a graduating class.

Reduced-Load Students: Full-time students may obtain exemption from minimum load requirements upon approval of the Advising Office. Such exemption is ordinarily granted on the basis of health, personal or academic reasons. Reduced-load students are considered full-time in all benefits, fees and obligations. The semester is counted as one of the 10 semesters toward graduation. A regular student may not normally enter the non-classified degree status.

Non-Classified Degree Students: Students who are admitted to degree status on the same basis as full-time students, but with the expectation of only part-time pursuit of the degree are considered Non-Classified Students. They are given a classification of "NC". For their initial enrollment they are classified as Freshmen or Transfers by the Admissions Office. They are assigned to an adviser for appropriate counseling and pre-registration advising. Non-Classified Students are billed on the advice of the Advising Office in the same manner as Special Students.

II. NON-DEGREE STUDENTS

Special Students: A transient student accepted for courses on a non-continuing basis is assigned to this category (class designation is "SP"). No evaluation of transfer credentials or course advising is offered to students in this category nor are they entitled to any student benefits. Their continuance is not automatic but at the discretion of the Admissions Committee. In order for a Special Student to be reclassified as a regular student he must make an appeal through the Admissions Committee.

Tuition, Fees and Expenses

TUITION

As a state institution, the University of Massachusetts at Boston offers a low rate of tuition to all students entering from the Commonwealth. Eligibility for admission under the low residential rate is determined in accordance with the following policy established by the Board of Trustees.

A student must present evidence satisfactory to the Treasurer of the University that his domicile is in the Commonwealth of Massachusetts in order to be considered eligible to register in the University as a resident student. He must also have established a *bona fide* residence in the Commonwealth for a period of not less than one continuous year prior to the date of acceptance at the University, and certify his intention to continue to maintain such a residence.

The domicile of a minor shall follow that of the parents unless such minor has been emancipated. In case of emancipation, the student, in addition to the requirements of these regulations respecting residence, shall present satisfactory proof respecting emancipation. Minors under guardianship shall be required to present, in addition to the certification of the domicile of the guardian, satisfactory documentary evidence of the appointment of the guardian. No student shall be considered to have gained residence by reason of his attendance in the University, nor shall a student lose residential preference during his continuous attendance at the University. The residence of a wife shall follow that of a husband. The prescribed form of application for classification as to residence status must be executed by each student. Misrepresentation of facts in order to evade the payment of out-of-state tuition shall be considered sufficient cause for suspension or permanent exclusion from the University. Discretion to adjust individual cases within the spirit of these rules is lodged with the President of the University.

EXPENSES

Normally expenses vary from approximately \$400 to \$500 per year. The following estimate of a year's expenses includes only those items which are strictly college-related. Tuition for residents of Massachusetts is \$250* per year and for others \$850.

Tuition	\$250*
Student Activities Fee	30
Health Services Fee	26
Student Medical/Surgical Insurance (12 months' coverage, optional)	30
Books, stationery, laboratory and other supplies (estimate)	200
* Subject to change.	\$536

No provision is made for room and board expenses as the University of Massachusetts at Boston is non-residential.

INITIAL PAYMENT FOR FRESHMEN

The initial payment for first semester expenses required of freshmen and transfer students prior to fall registration, and other expenses reasonably expected, are indicated below:

	<i>Residents of Massachusetts</i>	<i>All Others</i>
Tuition	\$125*	\$425*
Less Credit for Matriculation Fee (Non-Refundable) (15)		(15)
Net Tuition	110	410
Student Activities Fee	15	15
Health Services Fee	12	12
Student Medical/Surgical Insurance		
12 months' coverage (optional)	30	30
Orientation Fee (paid upon acceptance) (Non-Refundable)	15	15
Total of first semester Student Fee Bill	\$182	\$482
Books, stationery, laboratory and other supplies (estimate)	50	50
Total	\$232	\$532

* Subject to change.

The figures for books, stationery, etc., are approximate; they vary depending upon courses chosen and individual needs. Students should be prepared to pay cash for books and incidental supplies. Certain departments make special charges for necessary laboratory supplies. A bill will be rendered to the parent of each student prior to the beginning of the semester.

STUDENT ACTIVITIES FEE

Used to support programs and activities beneficial to students, such as the recognized student organizations and the University Cultural Events Committee.

STUDENT HEALTH FEE

Used to support the University Health Services and its programs.

MEDICAL/SURGICAL INSURANCE

An optional plan providing hospital, medical, and surgical care on a twelve-month basis for injuries or illness during the school year, holidays and summer vacation. Students who register for the Fall semester have only one opportunity to enter this program each year, at the time of payment of the Fall semester bill. It is also offered on the Spring semester bill for new Spring registrants only. Dependents of married students are not covered under this plan. Cov-

erage for dependents is available at additional cost. Inquire at the University Health Services.

PAYMENT DUE DATES

In accordance with University policy all charges for tuition and fees are due and payable approximately 21 days prior to the date of registration of each semester. Bills will be rendered in advance with due date shown and should be returned with the proper payment to the Bursar's Office, University of Massachusetts at Boston, 100 Arlington Street, Boston, Massachusetts 02116. Students may not register until all University charges are paid or otherwise accounted for.

SCHOLARSHIP PAYMENTS

It is the responsibility of all scholarship holders to see that the University is adequately notified prior to the time fee bills are prepared. Known scholarships are shown on the fee bills. If such items are not shown, deductions may not be made from the bill until satisfactory evidence has been presented to the Treasurer of the University by the donor.

LATE PAYMENT AND REGISTRATION

Any student who does not make payment of his semester charges by the date specified may be required to pay a late payment fee of \$5.

TUITION AND FEE REFUNDS

A student who leaves the University for any reason, except as specified below, before a semester is completed will be granted a *pro rata* refund of tuition and fees. A student who makes an advance payment and then for any reason does not attend any part of the next semester or term at the University will be given a full refund of tuition and fees. The \$15 admission (matriculation) payment and the \$15 orientation payment required of new students are not refundable. A student called into military service before completion of a semester will be given a *pro rata* refund of tuition and fees provided that he receives no academic credit for the work of that semester. If academic credit is given, there will be no refund. A student who is suspended or expelled from the University for disciplinary reasons forfeits all rights to a refund.

REFUND SCHEDULE

Regular term

- a. Within the first two weeks from the beginning of semester or term
(Registration Day) 80%
- b. During the third week 60%
- c. During the fourth week 40%
- d. During the fifth week 20%
- e. After the fifth week no refund

Refunds are based upon the withdrawal date established by the Registrar.

Veterans

Any veteran whose service is credited to the Commonwealth of Massachusetts (i.e., Massachusetts resident at time of entry into service), and who has served 180 days active duty since February 1955, is eligible to attend the University tuition free. Instructions relative to the procedure to obtain this tuition waiver are available at the Registrar's Office. This tuition waiver covers a period of four years but must be renewed each year. Summer school attendance must have a renewal of the tuition waiver but is not charged as a renewal if the courses taken in summer school are required for a degree.

Information concerning veterans status and payments under Federal and State laws is available at the Registrar's Office.

Certificates of eligibility for schooling are issued by the Veterans Administration upon application by the veteran. Upon receipt of the certificate of eligibility, the veteran should deliver it to the Registrar's Office for processing.

Responsibility for any change in status rests with the veteran. Any change in a veteran's status while attending the University in relation to semester hour credits, marriage, dependents or withdrawal should be reported immediately to the Registrar's Office.

Financial Aid

Financial aid at the University of Massachusetts at Boston is awarded to those students who cannot provide the full cost of their college education through their own and their families' reasonable efforts. The term "financial aid" is used to include scholarships, grants, long-term loans and part-time employment.

Applications for financial aid should be filed at the same time as the application for admission. The filing of an application for financial aid will have no influence on the decision for admission.

All awards are made on an academic year basis only. A student must apply each year for any type of aid for the following year.

MASSACHUSETTS STATE SCHOLARSHIPS

The Board of Higher Education awards scholarships to students who attend the University of Massachusetts at Boston. *All students who apply for aid to the University should also apply for a Massachusetts State Scholarship.* Applications are available at secondary school guidance offices or at the Board of Higher Education Scholarship Office, 182 Tremont Street, Boston 02111. The application deadline is December 15, 1972, and Parents' Confidential Statements should be filed with College Scholarship Service by December 1, 1972.

UNIVERSITY SCHOLARSHIPS

University Scholarships are available for residents of Massachusetts. Only those students in the top 10-25 percent of their class with above average per-

formance on the College Entrance Examination and a financial need will be considered for scholarships.

I.B.T.W. SCHOLARSHIPS

I.B.T.W., Local #1 Scholarships are tuition scholarships for sons and daughters of former members of Local #1 of the International Brotherhood of Telephone Workers. Half of the awards will be made to freshman applicants. Further information and special applications should be requested from the Financial Aid Office.

EDUCATION OPPORTUNITY GRANTS

Education Opportunity Grants are gift awards given to academically promising students in accordance with special requirements set by the Higher Education Act of 1965. These grants are designed especially for students of low income families.

LOANS

The major sources for loans are the National Defense Student Loan Fund and Federally-supported State Guaranteed Loan Programs.

- a. National Defense Student Loans are available through Federal funds received by the University. Federal legislation permits students needing money to borrow up to \$1,000 per year for five years. The actual amount of the loan is determined by the student's needs and by the amount of Federal funds made available to the University. No interest is charged on loans until repayment begins. The repayment period starts nine months after the student ends his studies, and may be extended over a 10-year period at an interest charge of 3 percent on the unpaid balance. Repayment of capital and interest may be deferred up to a total of three years while a borrower is serving in the Armed Forces, with the Peace Corps, or as a Volunteer in Service to America (VISTA). Also, no payments are required so long as the student remains at least a half-time student at the undergraduate level. There are provisions for cancelling all or part of this loan if the student enters the teaching profession.
- b. Students may apply for loans under the Guaranteed Loan Program in their home states. This program, established by the Higher Education Act of 1965, varies from state to state. Generally, undergraduate students may borrow up to \$1,000 per academic year with a total maximum of \$5,000, while a graduate student may borrow up to \$1,500 per academic year; the total sum of \$7,500 for one student's undergraduate and graduate study may not be exceeded. Commercial banks, mutual savings banks, savings and loan association, credit unions and other financial institutions subject to Federal or State supervision may be lenders under this program. A student should make application directly to one of these participating institutions, preferably to one located in the city or town of his permanent residence. The Uni-

versity is asked to certify the enrollment and good academic standing of the student, the reasonableness of his college expenses, and the amount of financial aid available from sources other than his family. These loans are considered a part of the financial aid package.

If the borrower's parents have an adjusted gross income of less than \$15,000 at the time he makes the loan, he need not pay interest until the repayment period begins, and then pays the regular 7 percent on the unpaid balance. Repayment begins nine to twelve months after the borrower has completed his studies and may be deferred while he serves in the Armed Forces or the Peace Corps. The repayment period may be five to ten years on loans of more than \$2,000 and one to five years on loans less than \$2,000.

PART-TIME EMPLOYMENT

Part-time employment is available mainly through the College Work-Study Program, part of which is supported by the Federal Work-Study Program, and will be given as part of the financial aid package. This will require eight to 15 hours of work per week for students who need financial aid. Students are paid weekly for the hours they have worked.

APPLICATION PROCEDURE

- a. Pre-Freshmen applicants should obtain from their school's guidance office a copy of the Parents' Confidential Statement prepared by the College Scholarship Service. That statement should be mailed directly to the Service at the time the student applies for admission, but no later than March 1. The University of Massachusetts at Boston should be listed under item 13. Upon receipt of a copy of the Parents' Confidential Statement, an application form will be sent to the student.
- b. Transfer and upper-class students should obtain applications and Parents' Confidential Statements from the Financial Aid Office. Applications are due by March 1.

Transfer students who received financial aid from the school from which they are transferring, should request the Financial Aid Office at that school to send a record of their awards to the University Financial Aid Office.

AWARDS

The amount of awards is determined by degree of need and may range from \$100 to full cost of attending school. A fuller explanation of determination of need is available in the Financial Aid Office.

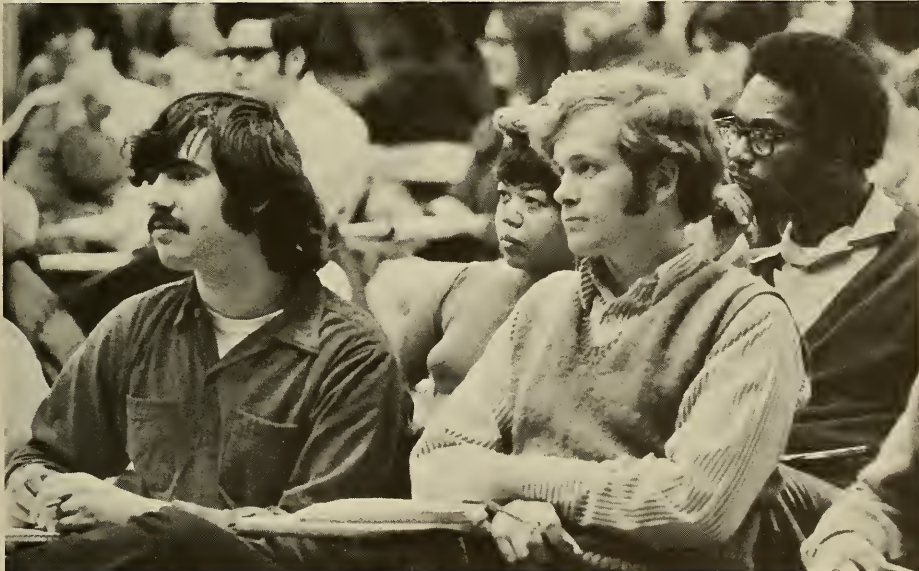
Announcement of awards will be made by means of an award letter as soon as possible following the applicant's acceptance by the University. Further communication with the Financial Aid Office is unnecessary, as each applicant will receive an answer as soon as a decision has been made.

University Health Services

The medical care provided by the University Health Services is structured primarily for the well-being of the student population at the University of Massachusetts at Boston. The program is student-oriented, and the services offered are those which have real meaning for the student. The services exist to help minimize loss of student time and energy from educational pursuits for reasons of health. Two registered nurses are on duty from 8:30 a.m. to 5 p.m., and both clinical and laboratory facilities are offered. Physicians and psychiatrists are available on an appointment basis, and special consultants are arranged when necessary.

The physical examination and medical history of each student is reviewed by a physician before registration. The University Health Service is aware, therefore, of any pre-existing medical problems which either require medical care or might necessitate a modification of the student's academic or athletic program. All medical records are held in the strictest confidence by the University Health Services.

The Health Services are supported by the Health Service Trust Fund, constituted by the fee which each student is required to pay. Students are urged to enroll in the University of Massachusetts at Boston J. C. Paige Student Hospitalization Insurance Plan. This insurance plan entitles the student to extensive but not total hospital services, in-patient physician's care, out-patient surgical care, accident insurance, referral to specialty consultants, X-ray and laboratory diagnosis, etc. A full description is available at the University Health Services office.



Housing

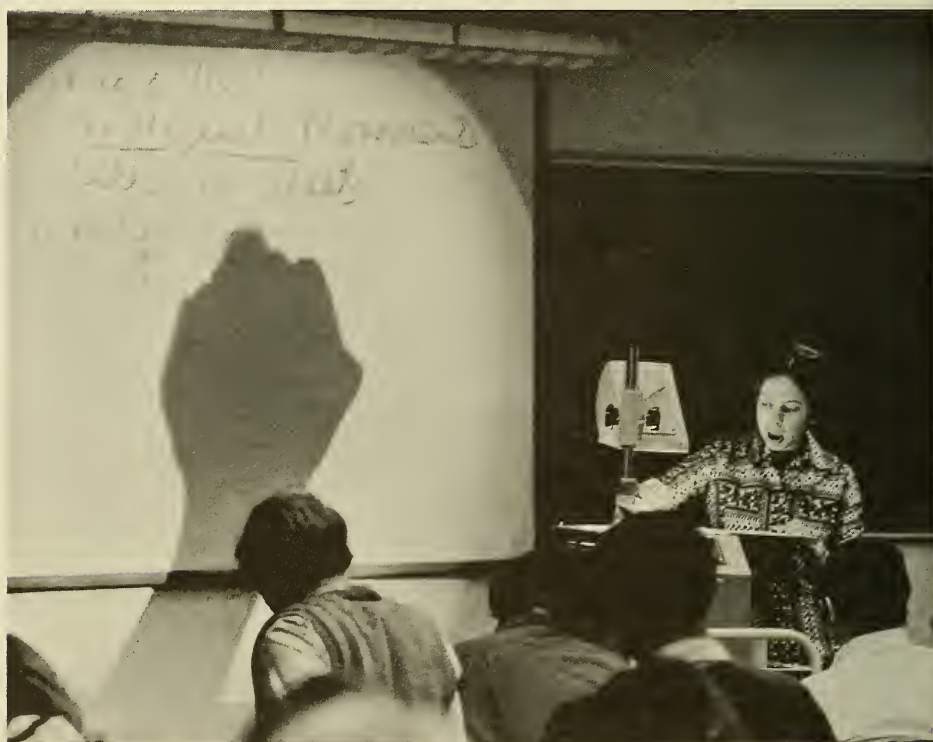
The University of Massachusetts at Boston is a commuting institution. As such, living arrangements are the sole concern and responsibility of the students and their parents. It is not the policy of the University to assist in housing.

Office of Student Affairs

The Office of Student Affairs includes, either completely or in cooperation with other offices, the following areas:

Career planning	Handicapped students
Communication with parents	Intramural athletics
Counseling	Orientation program
Cultural events programs	Placement
Discipline	Recognized student organizations
Financial aid	Student activities
Foreign students	

For further details, students are urged to consult the Student Handbook.



Advising and Study Counseling

The staff of the Advising Office is available to students to provide them with information on the curriculum, general requirements and program planning. Tutorial and study skills assistance is available to students through this office. Small classes in basic writing techniques and in reading skills are established each semester. Group tutorials are available in the core courses such as mathematics, languages, and natural sciences. Students and faculty members should contact the Advising Office for further information on both types of programs.

All freshmen are advised by members of the Board of Freshman Advisers; upperclassmen are advised by faculty members in their major departments. Students undecided on a major should consult with a member of the Advising Office staff.

Vocational Counseling and Placement

The services of the Vocational Counseling and Placement Office of the University are available to all registered students and alumni.

The principal services provided by this office are:

- Individual and small group counseling
- Off-campus part-time employment
- Full-time graduate placement
- Occupational and career information library
- Graduate school catalog library
- Fall and spring career seminars

All students, regardless of year in school, are encouraged to register with the Vocational Counseling and Placement Office and to share with members of the staff emerging concerns and questions relevant to their future plans.

Academic Regulations

Grades shall be reported according to the following letter system. No other interpretation of this letter system shall be authorized.

- | | |
|---------------|--------------------------------|
| A — Excellent | |
| B — Good | |
| C — Fair | Inc — Incomplete |
| D — Passing | P — Passing (pass/fail option) |
| F — Failure | |

The grade of Incomplete shall be reported only when a portion of the assigned or required class work, or the final examination, has not been completed because of the student's serious illness, extreme personal circumstances, or for scholarly reasons at the request of the instructor. If the student's record is such that he would fail the course regardless of the result of the missing work, he shall fail. A student can obtain credit for an Incomplete only by finishing the work of the course within the first two weeks of the following semester. The grade of Incomplete is converted to a failure if the course requirements have not been satisfied by that time. Exceptions to the two-week deadline may be requested from the appropriate agency in cases of protracted illness, critical personal problems, or for scholarly reasons at the request of the instructor. The initiative for removal of the Incomplete grade rests with the student.

An Incomplete on a final grade report is not calculated in arriving at a temporary quality point average. When the Incomplete is later converted to a grade, the permanent record is changed and the student is notified.

Once a grade is submitted, it cannot be changed except on approval of the Department Chairman.



PASS/FAIL OPTION

A student may elect one course each semester to a maximum of eight on a pass/fail basis provided he presents a P/F Option card to the Registrar's Office at the mid-term. The grade of pass will be included in the graduation credits but not in the quality points or cumulative average. A P/F once submitted, cannot be withdrawn or changed to a grade. A student must be carrying 12 or more credits during the semester in which he elects the P/F.

QUALITY POINTS

Quality points are assigned to course grades as follows: A, 4; B, 3; C, 2; D, 1; F, 0. The quality points for each grade are multiplied by the number of credits for the course, and the totals for all courses are added to arrive at the number of cumulative quality points. The number of cumulative quality points is divided by the number of cumulative credits carried to arrive at the cumulative quality point average. A P is not averaged in the cumulative average.

RETENTION AND GOOD STANDING

Cumulative Index Required For Retention

<i>Semester</i>	<i>Cumulative Average Retention</i>
1	0.0
2	1.3
3	1.5
4	1.6
5	1.7
6	1.8
7	1.9
8	2.0

Note: Students who elect a five-year program are expected to maintain a 2.0 average for the last three semesters.

Academic Dismissal

A student whose cumulative average falls below the requirement for retention will be academically dismissed.

Scholastic Probation

A student will be placed on scholastic probation if his semester average is below 1.5 after any of the first three semesters or below 2.0 after any of the subsequent semesters.

Any student who is at the probation level shall be warned by a statement on the bottom of his copy of the grade report. This warning is to indicate that continued below-standard performance will result in failure to graduate or in academic dismissal.

Probation precludes membership in University Senate, University committees and holding office in student organizations for the following semester.

Probation Appeals

The Committee on Standards and Scholarship shall be charged with modifying, extending, or limiting the restrictions on a student during a period of scholastic probation, and determining the limit of its duration. The Committee shall report all such modifications to the University Senate.

Readmitted Students

A readmitted student must attain the cumulative average required for the class to which he has been assigned at the time of readmission.

Transfer Students

The former cumulative average of a transfer student does not carry over to this University; he begins a new cumulative average upon admission. A transfer student is not dismissed after the first semester because of his cumulative average. However, for all subsequent semesters, the student must attain the cumulative average necessary for the class to which he was assigned.

Failed Courses

A failed course in a subject required for the degree must be repeated. If the failed course is not required, a substitution may be made upon the approval of the student's adviser. If repeated and passed, the original failed course remains on the student's record but will not be computed in the cumulative average.

A course once passed may not be repeated for a higher grade.

COURSE CHANGES—FIRST TEN ACADEMIC DAYS

1. Add Period — the student is allowed 10 academic days from the beginning of the semester to add, drop, or substitute a course WITHOUT NOTATION on his record.
2. Add/Drop Procedure — If a student has good reason to drop one course and add another, he may accomplish this in the following order:
 - a. Secure an Add/Drop card from the Registrar's Office.
 - b. Have the instructor of the course to be added certify that space is available in the desired section.
 - c. Secure release from the instructor of the course to be dropped.
 - d. Secure the Adviser's signature.
 - e. Submit the completed Add/Drop card to the Registrar's Office.
3. Withdrawal — If the student simply wishes to withdraw from a course (within the first ten days) he may do so with his instructor's approval, using the following procedure:
 - a. Obtain an Add/Drop card from the Registrar's Office.
 - b. Obtain the necessary signatures and return the card to the Registrar's Office.

COURSE CHANGES — AFTER 10TH ACADEMIC DAY

1. From the 11th academic day to a specified date before the beginning of the examination period, a student may drop a course subject to minimum load regulations (12 credit hours for matriculated student). The notation of withdrawal on the student's record will be the grade of "W" which is not computed in the grade point average.
2. Procedure — (11th day to a specified date before examination period). To be properly withdrawn from a course the student must accomplish the following:
 - a. Secure a Course Withdrawal card from the Advising Office.
 - b. Schedule a conference with his adviser and the instructor of the course and secure their signatures.

WITHDRAWAL FROM THE UNIVERSITY

1. If a student withdraws prior to a specified date before the first final examination, a "W" will be recorded in his permanent record file. The courses in which he was enrolled will be recorded along with his withdrawal date.

The effective date of withdrawal is that on which all proper forms are completed, signed, and returned to the Registrar.
2. Withdrawal Procedure — To withdraw from the University, the student must do the following:
 - a. Consult with a member of the Advising Office staff, who will provide and sign the necessary form.
 - b. Receive clearance from all departments of the University where he may have accrued charges: Library, Laboratories, Health Services, Treasurer's Office, Student Affairs Office, Book Store. This will clear the student's records so that he may obtain appropriate refunds and/or transcripts.
 - c. Return the form to the Registrar.
3. If any charges are outstanding, the student's permanent records will be "frozen" and no transcripts can be issued. Failure to complete a Withdrawal form will result in the recording of the grade of F in all courses at the conclusion of the semester.
4. Any student withdrawing during the fall semester after the *November 15 readmission deadline* will not be able to return for the spring semester.

CHANGE OF MAJOR

Any student who has stated a major and wishes to change it should consult first with a member of the Advising Office staff. Upon approval of the change, the departments involved and the Registrar's Office will be notified, and the student will be assigned to a new adviser by the new department.

ATTENDANCE

Attendance at all scheduled classes is expected. No administrative control of attendance is exercised except as hereinafter provided. In cases of illness,

students are to explain their absences directly to their instructors. Grades of students who meet requirements of the instructor in making up work shall not be reduced for absence because of illness.

All absences due to illnesses should be reported to University Health Services. Although students are expected to deal directly with faculty members, the Health Services will verify dates of absences if requested by faculty members.

CONDUCT

A high standard of conduct, based on self-respect and consideration for the rights of others, is expected of all students. The disciplinary system of the University is based upon a published Code of Student Conduct, and is administered by a committee of faculty and students. Hearings are conducted so as to ensure due process and guarantee fair and impartial consideration. It should be understood that the University, acting through its Chancellor or any administrative officer designated by him, in emergency situations, distinctly reserves the right to suspend a student. A student so suspended by administrative action is entitled to a speedy consideration and disposition of his case by the University Committee on Student Discipline.

COURSE LOAD

The normal course load for Freshmen and Sophomores is four courses for 16 credit hours and for Juniors and Seniors, five courses for 15 credit hours. A student with a cumulative grade average of 3.0 or 3.5 in the previous semester, may take an extra course with the permission of his adviser.

A student majoring in a Science who must take laboratory courses of more than 4 credits may assume a load of 18 credits. This is intended especially for Juniors and Seniors who may find it necessary to take three 3-credit courses, a required 4-credit core curriculum course, and a 5-credit laboratory course (or a similar variation) in one semester.

Students may elect to plan a four-year (eight semester) or five-year (10 semester) program.

SUMMER COURSES OUTSIDE THE UNIVERSITY

In order to receive credit for summer course work outside the University, a student must receive prior authorization from the department concerned for each course to be taken. A Course Authorization form can be obtained from the Registrar's Office; the original to be returned to the Registrar, one copy to be retained by the Department, and one copy to be retained by the student. In general, a grade of B or higher is required for transfer credit. Permission to accept a grade lower than B may be obtained only from the Department to which the credit is being transferred. It is the student's responsibility to see that a transcript is sent to the Registrar upon completion of the program.



HONORS PROGRAMS

To graduate with Departmental Honors, a student must have either: (1) successfully completed some special honors work, such as a thesis or seminar; or (2) gained a 3.5 grade average in his major field, the awarding of honors not to be automatic, however, but to depend on the recommendation of an honors committee in his department.

The student must, in addition, have a 3.0 overall grade average. (Note that this governs *graduation* with honors, not admission to honors work, which is left to the discretion of the departmental honors committee.)

Not more than 6 credits may be received for special honors work.

If a student entered in an honors course completes the work satisfactorily but not on an honors level, he shall receive credit for the course toward graduation.

GRADUATION REQUIREMENTS

In order to graduate, a student must acquire a total of 124 credits. Students who qualify for advanced placement in languages or other 4-credit freshman-sophomore courses may graduate with as few as 120 credits. All students must accumulate a minimum of 45 Residency credits at the University.

A student must meet the requirements of a major department.

A student must complete either the A. or the B. pattern of courses below.

A. Core Requirement

1. One year of training in writing to be taken in the Freshman year.
2. Courses in foreign language as follows: Students who demonstrate proficiency in a foreign language at the intermediate level shall be exempt from a language requirement. Students who meet the entrance requirements regarding language or who otherwise demonstrate elementary proficiency in a foreign language shall take one year of a foreign language at the intermediate level *or* one year of a foreign literature in translation.
3. Three terms of course work in the social sciences, of which at least one must be taken in History and one in another discipline.
4. Three terms of course work in the natural sciences or in mathematics, of which at least two terms must be taken in the same discipline, and at least one in a natural science.

B. As an alternative to A. a student may choose to design his or her own core curriculum, in consultation with a faculty adviser or with an advising committee. Questions concerning this program should be referred to the Advising Office.

FINAL EXAMINATIONS

When the examination schedule is published, any student who finds himself scheduled for two examinations at the same time or for three examinations in one day should report the situation directly to the Registrar's Office.

PRIZES AND AWARDS

Brian Rattigan Prize

A cash award made annually for outstanding creative achievement. Established by his friends and classmates in memory of Brian Rattigan, a poet and member of the first graduating class of the University of Massachusetts at Boston, who drowned during the summer before his Senior year. Selection of the recipient is made by a special committee of faculty and students.

John W. Ryan 1966 Faculty Convocation Award

Awarded each year at the Honors Reception to the Junior who attained the highest average at the completion of the second year at the University. Established in 1966 partly in order to commemorate the convocation of the faculty and partly in order to recognize academic excellence in the student body.

Luis Emilio Soto Prize

Awarded each Spring at the Commencement Exercises to the Senior majoring in Spanish who best reflects the humanistic qualities and the spirit of Professor Soto.

Inaugurated in May 1970, and named for Professor Luis Emilio Soto (1902–1970), who, in his short stay at the University of Massachusetts at Boston, wholly won the hearts of his students and colleagues by his devotion to them and to their work.



Special Programs

Afro-American Studies Concentration

This special program, derived from the University's commitment to offer courses in both Western and non-Western studies, is specifically designed for students interested in the historical experience, cultural accomplishments, and significant presence of the Black man in Africa and the New World. Successful completion of the Concentration is formally acknowledged on students' official records.

Students must major in a department and are trained in its discipline while electing courses which emphasize Afro-American subject matter. Faculty advisers, and members of the Afro-American Studies Concentration Committee, assist students in choosing these courses.

Option A:

A minimum of six courses from the Approved List. At least three of these courses must be taken outside the major department.

Option B:

Honors Program. A Junior/Senior year honors program for highly qualified students who present to the Afro-American Studies Concentration Committee a satisfactory proposal for in-depth study of an appropriate subject or problem. Requires two semesters of an interdisciplinary Junior seminar (Afro-American Studies 390-391), the election of additional courses as appropriate, and the writing of an honors thesis during the Senior year which is acceptable to the Committee.

COURSE OFFERINGS

(3 hours, 3 credits each unless specified)

AFRO-AMERICAN STUDIES

390 (I), 391 (II) AFRO-AMERICAN STUDIES HONORS SEMINAR

An interdisciplinary seminar for students

admitted to Option B (Honors), and to a limited number of other highly qualified students participating in the Option A program.

Prerequisite: 3.0 overall average and permission of the Afro-American Studies Concentration Committee Staff

AFRO-AMERICAN STUDIES

398 (I), 399 (II) AFRO-AMERICAN STUDIES SENIOR HONORS THESIS

Study in depth of a topic chosen by the student in consultation with an honors adviser, and a paper written with the approval and under the direction of an honors adviser, normally related to work done in the Honors Seminar. Honors awarded on the basis of performance in the Honors Seminar, evaluation of the paper by the Afro-American Studies Concentration Committee, and 3.0 overall average.

Prerequisite: Afro-American Studies 390 and 391, and permission of the Afro-American Studies Concentration Committee Staff

ADDITIONAL APPROVED COURSE OFFERINGS

(See Department listings for complete course descriptions.) Students may petition the Afro-American Studies Concentration Committee for permission to include other relevant courses in their Concentration program. In addition a list of Inter-Institutional Black Studies courses is available from the Registrar. These courses will also be credited toward the Concentration.

Anthropology 122 Staff

Introduction to Anthropology

Anthropology 258 Staff

People and Cultures of Africa

Art 227 Mr. McCall

The Art of Africa

Economics 213 Mr. Torto

Urban Problems

Economics 243 Mrs. Garrity

Economic Problems and Prospects of Black America

English 349 Mr. Murray

Black Presence in American Literature

English 358	Mr. Senna
Black Literature in America	
English 381	Staff
Selected Topics	
French 263	Staff
The Black Soul and the Theatre	
French 358	Staff
Black French Literature	
History 117, 118	Mr. Amiji
Introduction to African Civilization I, II	
History 243	Mr. Amiji
Problems in African Civilization	
History 273	Mr. Ruchames
The Age of Jackson and Lincoln	
History 274	Mr. Ruchames
Civil War and Reconstruction	
History 328, 329	Mr. Stern
Black History in America	
History 375, 376	Mr. Amiji
History of Africa	
History 404	Staff
Seminar in American History	
Humanities 249	Mr. Senna
African Literature	
Music 251	Mr. Huggler
Jazz	
Music 252	Staff
Non-Jazz Black Music in America	
Politics 205	Staff
Afro-American Experience	
Politics 241	Miss Paul
Metropolitan Politics	
Politics 242	Miss Paul
Urban Problems	
Politics 257-258	Mr. Nketsia
Politics of Africa	
Politics 261	Mr. Beichman
National Development	
Sociology 221	Mr. Brill
Urban Community	
Sociology 252	Mr. Blackwell, Mr. Robbins
Racial and Ethnic Relations	
Sociology 316	Staff
Social Change and Modernization	
Spanish 232	Mrs. Osorio
Introduction to Latin-American Culture	

Institute for Learning and Teaching

The Institute for Learning and Teaching, established by the University Senate in

April, 1971, provides direct, on-site educational services to experienced teachers and others who work with children in the Boston metropolitan area. In addition, it offers in conjunction with academic departments selected programs for undergraduates who are contemplating careers in child-serving professions, and encourages cooperation among Boston area institutions concerned with teacher training.

In cooperation with the Boston School Department, the Institute is helping prepare teachers who have been reassigned to newly-constructed open-space schools. A second program focuses on training for parochial school teachers in several schools in East Boston. A third is directed at helping the staff of the Bilingual Education Department in Boston address the educational problems of the Spanish-speaking. A fourth focuses on working with high school staffs regarding the underlying problems of secondary school unrest.

In these projects, an Institute staff member develops a close working relationship with a designated group of professionals; and as the members of the group identify their training needs, appropriate resources are mustered to meet these needs. These resources — adjunct professors, master teachers, and curriculum materials — are the faculty of the Institute. It has no standing faculty *per se*.

On the undergraduate level, the Institute has joined with the Sociology Department to offer a concentration of study and field work called "Sociology and Urban Social Service." (A more detailed description of this program appears under the heading "Urban Social Service" in this section.) By September, 1972, the Institute will have expanded its undergraduate offerings to include other co-operative programs. Information on these should be available before that time.

The Institute encourages those interested in learning more about its activities to visit its offices at the Salada Building, Room 504.

Pre-Medical Program

A student interested in a medical, dental or veterinary career may select any of the majors offered at the University of Massachusetts at Boston on the basis of interest, ability and suitability for an alternative career. In addition he must satisfy the following minimal premedical requirements: English 101-102 or equivalent; Mathematics 103, 105 and preferably 106; Chemistry 103-104, 155-156 (or 153-154); Physics 103-104 (or 111-112, or 101-102); and Biology 101-102.

Students who demonstrate interest in and ability for a medical career should register with the Pre-medical Committee. The Committee will advise the student on matters concerning undergraduate curriculum, applications to dental, medical and veterinary schools, and will oversee the evaluation of his record at the University of Massachusetts at Boston. Students should seek out information on graduate admission requirements as early as possible. Additional details may be obtained from Mr. Laufer, Department of Chemistry, and Mr. Schultz, Department of Biology.

Religious Studies Concentration

Designed for students who wish to pursue an interdisciplinary study of religion, this concentration is connected with a departmental major, the training in which will provide the student with strength in one particular discipline. The balance of the concentration will be elected from courses in other departments and disciplines.

The Interdepartmental Committee on the Study of Religion assists and advises students interested in designing a program of study in the field of religion. A student in his fourth, fifth or sixth semester whose interests lie in this field is invited to discuss his concerns with any member of the Interdepartmental Com-

mittee with a view toward designing a coherent and feasible program of study. The student and his faculty adviser will submit this program to the Interdepartmental Committee for review and approval. Successful completion of the concentration is formally acknowledged on students' official records.

COURSES IN, OR CLOSELY RELATED TO, THE STUDY OF RELIGION

English 275	Mrs. Collins
The Medieval Period	
English 304	Miss Edwards
Medieval Poetry	
English 322	Mr. Chernaik
English Poetry of the Early 17th Century	
English 326	Staff
Milton	
English 339	Mr. Schreiber
Blake	
French 374	Staff
Catholic Literature from 1800-1930	
History 210	Mr. Percy
Early Middle Ages	
History 211	Mr. Percy
Later Middle Ages	
History 212, 213	Mrs. Watkins
Age of the Renaissance and Reformation	
History 237	Mr. Segal
Jewish History: Antiquity to the Late Middle Ages	
History 238	Mr. Segal
Jewish History: From the Spanish Expulsion to Modern Statehood	
History 239	Mr. Ahmad, Mrs. Hoffman
The Middle East, 622-1517	
History 243	Mr. Amiji
Problems in African Civilization	
Humanities 109	Mr. Williamson
Patterns of Religious Meaning and Action	
Humanities 231	Staff
Hindu Religion	
Humanities 232	Staff
Buddhist Religion	
Humanities 241, 242	Mr. Horsley
Introduction to Biblical Literature	
Humanities 243	Mrs. Mendillo
Mythology and Literature	
Humanities 260	Mr. Schreiber
Visionary and Prophetic Modes in Literature	
Italian 301, 302	Mr. Carrara
Dante and the Duecento	
Philosophy 201	Mr. Cohen
Ancient and Medieval Philosophy	

Philosophy 251	Staff
Plato	
Philosophy 260	Mr. Clive
Philosophy of Religion	
Philosophy 291	Mr. Clive
Existentialism	
Sociology 339	Mr. Zahn
Sociology of Religion	
Sociology 502	Mr. Zahn
Sociology of Social Movements	

Teacher Certification Program

Students seeking careers in education may avail themselves of the services of the Teacher Certification Program. The staff provides information and counseling to all students interested in preparing to teach. In addition, the program enables highly qualified students who have demonstrated a potential for leadership in the school to satisfy Massachusetts requirements for certification. Since the University at Boston offers no major in Education, a teaching candidate pursues the University's normal degree and major sequences. At the same time, by judicious choice of electives from among those offered by several departments, he may acquire credits in courses approved for certification. The program culminates in the Senior year when, under the direction of the faculty of his major department, the student enters practice teaching and participates concurrently in a curriculum-and-methods seminar.

REQUIREMENTS FOR CERTIFICATION

The Commonwealth of Massachusetts issues teaching certificates to American citizens who hold the bachelor's degree and who comply with certain additional requirements. Briefly summarized, those requirements are, for elementary teaching, 18 credits in approved courses; for secondary teaching, 12 credits in approved courses, plus concentration in a subject taught in the secondary school. Approved courses must include at least two of the following four areas: Psychology of Education, Philosophy of Education, Curriculum, Methods of In-

struction. Supervised teaching experience is also necessary for both the elementary and secondary certificate. Students admitted to the Senior year program (see below) automatically include "Methods of Instruction" in the Practice Teaching semester and receive 9 approved education credits toward Massachusetts certification. Students also elect appropriate courses in the other three subject areas.

ADMISSION TO THE TEACHER CERTIFICATION PROGRAM

With the exception of the Senior curriculum-and-methods seminar and concurrent practice teaching, all courses leading to certification are open to every student. Only a limited number of students can be accepted for the Senior year program. Admission to the program is granted by the Teacher Certification Program Committee after a review of all applications. Admission is based on departmental approval, evaluation of academic performance and recommendation of the coordinator of TCP.

APPLICATION PROCEDURE

Because preparation for teaching makes demands beyond those ordinarily required to earn a degree, the prospective candidate must begin to plan early. He should register with the Teacher Certification Program before the middle of his Sophomore year, and should seek assistance in planning his future program from the TCP coordinator and from a member of his major department. He may want to consider attending at least one Summer Session in order to relieve the pressures of the Senior year, when practice teaching will claim a large share of his time and energy.

Those who wish to enroll in the curriculum-and-methods/practice teaching sequence must apply for admission before February 15 of the Junior year. Application forms are available in the TCP office.

COURSES APPROVED FOR CERTIFICATION

The following courses may be counted toward fulfillment of Massachusetts cer-

tification requirements. * Starred courses are especially recommended.

Economics 141	Economic Literacy
English 252	Advanced Composition
English 374	Principles and Methods of Literary Criticism
English 375	History of the English Language
French 362	The Theme of Education in French Literature
History 403	Seminar in European History
History 404	Seminar in American History
History 325	American Social History from the Civil War to the Present
*Philosophy 281	Philosophy of Education
Psychology 237	Developmental Psychology
*Psychology 239	Educational Psychology
Psychology 250	Theories and Fundamental Issues of Learning

The electives below are open only to Seniors who have completed two or more certification courses and who have been admitted to the Teacher Certification Program. All include full days of practice teaching, five days a week, for a period of 10 weeks, under the supervision of experienced teachers and University faculty. Students will find it mandatory to carry a reduced course load during the semester of practice teaching.

Each of the courses listed below is a 9-credit block. Each department determines the amount of credit (if any) granted toward the major. Students are advised to consult their major department concerning distribution of credit and scheduling of practice teaching.

Art 386	Methods and Practice Teaching of Art in Secondary Schools
Biology 386	Methods and Practice Teaching of Biology in Secondary Schools
Classics 386	Methods and Practice Teaching of Latin in Secondary Schools
English 386	Methods and Practice Teaching of English in Secondary Schools
French 386	Methods and Practice Teaching of French in Secondary Schools

German 386	Methods and Practice Teaching of German in Secondary Schools
Italian 386	Methods and Practice Teaching of Italian in Secondary Schools
Mathematics 386	Methods and Practice Teaching of Mathematics in Secondary Schools
Music 386	Methods and Practice Teaching of Music in Secondary Schools
Physical Science 386	Methods and Practice Teaching of Physical Science in Secondary Schools
Russian 386	Methods and Practice Teaching of Russian in Secondary Schools
Social Sciences 386	Methods and Practice Teaching of Social Sciences in Secondary Schools
Spanish 386	Methods and Practice Teaching of Spanish in Secondary Schools
TCP 390	Methods and Practice Teaching in Elementary Education

Students in departments not listed should consult with their departments to determine if such courses are to be offered.

Urban Social Service

The Urban Social Service Concentration is designed for dedicated students who wish, beginning in their freshman year, to major in sociology as preparation for a child-serving career in an urban setting. Students in this program take specially created sections of the sociology course offerings which coordinate their course work with field placement activity. Such students are expected to intern in a variety of social service agencies such as schools, hospitals, child guidance centers, recreational centers and other community agencies.

Entering freshmen interested in applying for the social service concentration should write to the Chairman of the Sociology Department.

Courses and Major Requirements

ANTHROPOLOGY

COLLEGE I

BARBARA AYRES, PH.D., Associate Professor of Anthropology and Chairman of Anthropology, College I; THOMAS HEARNE, B.A., PAUL DEVORE, M.A., Instructors in Anthropology.

COLLEGE II

DAVID LANDY, PH.D., Professor of Anthropology and Chairman of Anthropology, College II; GOLAMREZA FAZEL, PH.D., Assistant Professor of Anthropology; CHARLES NELSON, M.A., Instructor in Anthropology; LUCILLE KAPLAN, M.A., Part-time Instructor in Anthropology.

COURSE OFFERINGS

(3 hours, 3 credits each unless specified)

122 (I, II) INTRODUCTION TO ANTHROPOLOGY

An introduction to general anthropology, emphasizing biological and cultural evolution, primate and human biology and behavior. The nature of culture, including forms of shelter, clothing, ornament, art, handicrafts, religion, and political, juridical, economic, and social organization.

3 hours, 4 credits Staff
Prerequisites: All advanced Anthropology courses (200 level and above) require as a prerequisite Introductory Anthropology (An 122), or permission of instructor.

220 WORLD PREHISTORY I

From the origins of human culture to the agricultural revolution. Relationships between biological evolution and culture change in the Lower and Middle Pleistocene, and the development and spread of hunting-and-gathering societies in the Upper Pleistocene and Recent. Mr. Nelson

221 WORLD PREHISTORY II

From the Neolithic through the rise of cities. The origins of plant and animal domestication, the characteristics and spread of Neolithic societies, and the rise of city-states in the New and Old Worlds.

Mr. Nelson

225 MAN IN PREHISTORY

Human evolution and man's early cultural development. Integrates biological anthropology and prehistoric archeology. Emergence of hominids and living varieties of man. Analysis of cultural growth.

Mrs. Kaplan, Mr. Nelson

236 (I) COMPARATIVE ETHNOLOGY

The wide range of cultural variation to be found in different world regions. Intensive comparative analysis of representative cultures and social structures. Mrs. Ayres

237 METHODS OF CROSS-CULTURAL RESEARCH

An introduction to the theory and method of cross-cultural research. Practice in the design and implementation of a limited cross-cultural study. Mrs. Ayres

240 (I, II) PEASANT SOCIETY

The general features of peasant life as lived by 80 percent of the world's peoples. The distinctive social-cultural forms of peasant organization in different world regions.

Mr. DeVore

241 (I, II) MEDICAL ANTHROPOLOGY

Man's ecological adaptations to disease and illness considered in prehistorical, historical, and transcultural perspective. Medical systems considered as cultural and social systems related intimately to social structure, religion, economics, and other aspects of a society's way of life. Mr. Landy

242 POLITICAL ANTHROPOLOGY

A comparative approach to preindustrial and non-Western political organization considered as parts of sociocultural systems. Emphases include political activity, competition for power and authority, leadership, decision-making, etc., typologies of political systems; dynamics of change in light of theories of political change, archaic rebellions, etc. Mr. Hearne

244 ECONOMIC ANTHROPOLOGY

Peasant and preindustrial (nonmonetized, non-Western) economic systems. The relationships between economy and sociocultural systems. Mr. Fazel, Mr. Hearne

259 CULTURES OF EUROPE

Anthropological approaches to the study of European societies and cultures based primarily on the description and analysis of small local communities, their internal social organization, and their external relations with the national state.

Mr. Hearne

260 CULTURES OF MIDDLE EAST

Survey of Middle Eastern ethnology. An anthropological approach to the contemporary Middle East, with emphasis on nomadic and peasant populations.

Mr. Fazel

268 CULTURES OF MESOAMERICA

Survey of Mesoamerican ethnology. Social change in modern Mesoamerica; the modernization process and its relation to rural society; urbanization and the development of contemporary elites.

Mr. DeVore

269 THE PREHISTORY AND ETHNOHISTORY OF MESOAMERICA

From Formative to Post-Classic times; the Spanish Conquest and subsequent acculturation among Indian peoples, Europeans and Africans in Mesoamerica. The natural, indigenous, and linguistic culture areas. Sequel to Anthropology 268.

Prerequisite: Anthropology 121

Staff

270 PSYCHOLOGICAL ANTHROPOLOGY

The relationships between culture and the person, psychological factors in culture and society, and cultural factors in personality. The cultural channeling of individual temperament.

Mrs. Ayres, Mr. Landy

389 (I, II) SPECIAL TOPICS SEMINAR

Intensive study of special topics, varying each year according to instructor.

Staff

391 (II) ANTHROPOLOGICAL THEORY

Survey of the major theoretical positions in social and cultural anthropology, with special reference to contemporary approaches to problems of structure, function and process.

Staff

399 (I, II) DIRECTED STUDY IN ANTHROPOLOGY

Students may be invited by the Department to conduct independent research during the senior year. Supervision and guidance provided by the staff.

Staff

RELATED COURSES:

Psychology 270, (I, II) Social Psychology
Social Sciences 131 (I) Introduction to Social and Political Analysis
Social Sciences 226 (II) The Politics and Sociology of Ecology
Social Sciences 300 (I, II) Communications and Opinion

ART

COLLEGE II

BATES LOWRY, PH.D., Professor of Art and Chairman of Art, College II; RENEE M. ARB, PH.D., Associate Professor of Art; ROBERT KNOTT, PH.D., ANDREW RAMAGE, PH.D., Assistant Professors of Art; HAROLD THURMAN, M.A., STEVEN TREFONIDES, Resident Artists; ZIRKA ZAREMBA, M.A., Instructor in Art; SUSAN BUSH, PH.D., DANIEL MCCALL, PH.D., Lecturers in Art.

GRADUATION REQUIREMENTS

Majors in Art are required to take one introductory level course in both art history and creative work and a minimum of eight advanced courses which collectively provide a distribution among historical styles and media acceptable to a Departmental adviser. With permission of the Department, honors students may substitute a senior thesis for one or two of the advanced courses.

COURSE OFFERINGS

(3 hours, 3 credits each, unless specified)

CREATIVE ART

121 (I, II) VISUAL FUNDAMENTALS

Development of visual awareness through projects, lectures, discussions which use the camera and other media as a means of establishing new and creative relationships with a visual environment.

4 hours, 3 credits

Staff

131 (I) BASIC DESIGN

The elements of visual form organized on the two-dimensional plane; line, shape, volume, color, texture, etc. Exercises, lectures and discussions dealing with color theory and phenomena, space perception, composition, and form-content relationships.

4 hours, 3 credits

Mr. Thurman

132 (II) THREE-DIMENSIONAL DESIGN

The fundamental visual elements of three-dimensional form. Material/tactile qualities, mass, volume, kinetics, and their structural organization explored.

4 hours, 3 credits Mr. Thurman

133 (I, II) INTRODUCTORY DRAWING

Basic materials and techniques, with emphasis on drawing as a primary means for the description and interpretation of man and his environment. Problems in still life, landscape and life drawing.

4 hours, 3 credits
Mr. Trefonides, Mr. Thurman

233 (II) WORKSHOP IN DRAWING

Problems in a number of drawing media (ink, charcoal, pencil, chalk, etc.) approached through work with still-life, landscapes, and the human figure.

4 hours, 3 credits
Prerequisite: Permission of instructor Staff

235 (I), 236 (II) WORKSHOP IN PAINTING

Problems in the various painting media (oil, opaque, watercolor, acrylics) working from still-life, figure and landscape.

4 hours, 3 credits
Prerequisite: Permission of instructor Mr. Trefonides

335 (I), 336 (II) SENIOR WORKSHOP IN PAINTING

Advanced work in painting; a continuation of concern with materials and techniques begun in Art 235, 236.

4 hours, 3 credits
Prerequisite: Permission of instructor Mr. Thurman

HISTORY OF ART

101 (I, II) 102 (I, II) INTRODUCTION TO THE HISTORY OF ART

A survey of the major periods of national and individual styles in painting, sculpture and architecture from antiquity to the 20th century, with analysis of original material in the local museums.

3 hours, 4 credits Staff

111 (I, II) INTRODUCTION TO THE LANGUAGE OF ART

The nature of form, content, technique, and style in painting, sculpture, architecture and

graphic arts. Designed to sharpen the student's response to original works. Museum meetings alternated with lecture/discussions on key problems.

3 hours, 4 credits Staff

203 (I) THE ART OF GREECE

Greek art from the geometric through the Hellenistic periods, with the development of sculpture as the central theme.

Mr. Ramage

204 THE ART OF ROME

The painting, sculpture, and architecture of Rome and the Provinces from the Republican era to Constantine the Great; the influence of the emperors as a unifying element.

Mr. Ramage

205 INTRODUCTION TO ITALIAN RENAISSANCE PAINTING

The creation and flowering of the early Renaissance style in Florence. Masaccio, Fra Angelico, Piero della Francesca, Botticelli and Leonardo da Vinci, among others; their relationship to the different esthetic and intellectual responses in the various local centers.

Miss Arb

206 ITALIAN RENAISSANCE PAINTING: THE GOLDEN AGE

A definition of High Renaissance classicism and of the particular form the style took in Rome and Venice in the first three decades of the 16th century. Concentration on the careers of Raphael, del Sarto, Michelangelo, Giorgione, Titian and Correggio, with reference to relevant lesser personalities.

Miss Arb

207 NORTHERN ART FROM PUCELLE TO DUERER

An overview of the major trends and individual artists appearing in Northern Europe from the 14th to the 16th centuries. The development and interrelationships of such important figures as van Eyck, van der Weyden, Bosch, Grunewald, Bruegel, Duerer and Claus Sluter.

Miss Zaremba

209 ART OF THE BAROQUE

A panorama of the visual arts of Italy, Spain, France, Holland and England considered in relation to the expanded social and geographical horizons of the 17th century.

Miss Zaremba

221 19TH CENTURY ART

A broad survey of the visual arts stressing the vigorous counterpoint of esthetic and

social forces during a century of dynamic change. Emphasis on European painting.

Mr. Knott

222 20TH CENTURY ART

An introduction to the multiple innovations of style, theory, materials and techniques in the art of this century, and to the leading European painters and sculptors. Concentration on the first four decades when cubism, expressionism, fauvism and surrealism were developed.

Mr. Knott

223 ASPECTS OF BUDDHIST ART

A comparative survey of Buddhist architecture, sculpture, and painting with material which ranges from the rock-cut caves of India to the Zen ink paintings of Japan. Illustrates the development of Buddhist doctrines in Asia.

Mrs. Bush

225 (I, II) INDIAN ART AND ITS INFLUENCE

The sculpture, architecture, and painting of India and their influence in the Far East and Southeast Asia, including an introduction to the religious background of Buddhism and Hinduism.

Mrs. Bush

226 CHINESE PAINTING

The evolution of Chinese painting into a unique art form and its theory and social implications.

Mrs. Bush

227 (I) THE ART OF AFRICA

An introduction to the African arts (especially carved figures, masks, rock and wall paintings, textiles and ritual objects) in relation to the ethnic background as well as esthetic expression. Art historical problems within the continent and the impact of African forms on other cultures of the 19th and 20th centuries.

Mr. McCall

228 AMERICAN PAINTING AND SCULPTURE

Concentrates on the period between the Armory Show (1913) and the present. Discussion of major 19th century American artists and their relationship to currents of European art and taste.

Mr. Knott

229 FAR EASTERN PAINTING

The relationship of Chinese and Japanese painting, stressing the special characteristics of each. Scroll paintings, screen, and Japanese prints are discussed.

Mrs. Bush

241 (I) ORIGINS AND DEVELOPMENT OF WESTERN ARCHITECTURE

The evolution of architecture from its beginnings in Mesopotamia, Egypt and Greece through its development in the Renaissance and Baroque periods, with special attention to the relation of man and environment, the articulation of space, and the theory of architectural design.

Staff

242 (II) MODERN ARCHITECTURE

Problems in the theory of architectural design during the era of Romantic Classicism and the evolution of new potentials in the 19th century. The role of technology, new structural solutions, methods of construction, and the development of new conceptions of space for contemporary buildings.

Staff

303 FRENCH ART, 1500-1800

Selected problems in the development of a national art style during the creation of an absolutist form of government.

Prerequisite: Permission of instructor

Mr. Lowry

304 CLASSICAL PAINTING

The style and technique of Greek vase painting, wall painting and easel painting, with emphasis on literary tradition.

Prerequisite: Permission of instructor

Mr. Ramage

308 (I) MANNERISM IN THE VISUAL ARTS, 1520-1600

An exploration of the new style developed in Italy in reaction to Raphael's classicism which spread to Northern Europe between the High Renaissance and the Baroque. Form, theory and content in relation to the social crises of the Reformation and the Counter-Reformation. The 'psychology' of Mannerism and its relationship to the modern age.

Prerequisite: Permission of instructor

Miss Arb

309 MASTERS OF BAROQUE PAINTING

A detailed examination of the work of six masters: Caravaggio, Velasquez, Poussin, Rubens, Rembrandt and Vermeer.

Prerequisite: Permission of instructor

Staff

310 BERNINI, BORROMINI AND PIETRO DA CORTONA

The impact of Italian High Baroque style and theory on European taste of the 17th and 18th centuries, culminating in the north-

ern Baroque of Germany and Austria and the French Rococo.

Prerequisite: Permission of instructor
Staff

311 THE CLASSICAL TRADITION IN WESTERN ART

The Greco-Roman tradition in art and philosophy in periodic re-appearances or revivals of classical style and theory from the Middle Ages through the period of the First Empire in France.

Prerequisite: Permission of instructor
Miss Arb

321 SOURCES OF 20TH CENTURY PAINTING

A study of Cezanne, Van Gogh and Gauguin, the Symbolists and Art Nouveau, and the late 19th century break with the artistic premises of the Renaissance.

Prerequisite: Permission of instructor
Mr. Knott

322 EUROPEAN PAINTING AND SCULPTURE, 1925-1940

Specific themes developed in this fifteen year period by the painters Picasso, Klee, Miro, Ernst, and the sculptors Brancusi, Moore, Arp and Lipchitz will be explored to show the relationship between the work of art and contemporary ideas in psychology, anthropology, and primitive mythology.

Prerequisite: Permission of instructor
Mr. Knott

386 METHODS AND PRACTICE TEACHING OF ART IN SECONDARY SCHOOLS

The issues, principles and methods of teaching art in the schools. Supervision and critique of practice teaching.

3 hours, 20 hours laboratory (practice teaching), 9 credits

Prerequisite: 6 hours Education courses and admission to Teacher Certification Program.
Staff

391 (I) SEMINAR IN GRAPHIC ART

A close examination of original prints designed to develop knowledge of the technical processes (woodcut, engraving, etching, lithography) and their evolution, and to introduce the student to criteria of connoisseurship. Concentration on the leading masters such as Mantegna, Duerer, Rembrandt, Blake and Goya. Meetings in the Museum of Fine Arts, the Boston Public Library and the Fogg Museum.

Preference given to senior art majors. Staff

394 (II) SCULPTURE: FORM AND MEANING

An intensive study of the special qualities of the art of sculpture: types, techniques, function, iconography and style explored in lectures, discussions and field trips.

Preference given to senior art majors.
Miss Arb

395 (I), 396 (II) SPECIAL PROBLEMS

Independent investigation of a special area under the supervision of a qualified professor. Open only to a very limited number of students in any one semester. A written prospectus of the project is required of applicants.

Prerequisite: Permission of instructor and Department Chairman
Staff

Available for additional credit in Art:

History 207 (II) INTRODUCTION TO CLASSICAL ARCHEOLOGY

Offered jointly by the Art and History Departments. A survey of the art, archeology and history of Bronze Age Greece and Asia Minor. Introduction to the methods and aims of archeology and to the geographical and historical background of the period. The major area cultures: the Minoan civilizations, Mycenaean Greece, Troy and the Hittite Empire.

Prerequisite: Junior standing or Departmental approval
Mr. Foss, Mr. Ramage

BIOLOGY COLLEGE I

FUAD M. SAFWAT, PH.D., Associate Professor of Biology and Chairman of Biology, College I; LAWRENCE KAPLAN, PH.D., HERBERT LIPKE, PH.D., Professors of Biology; RICHARD WHITE, PH.D., Associate Professor of Biology; BETTINA HARRISON, PH.D., JEREMY J. HATCH, PH.D., CHRISTINE KIBEL, PH.D., STANLEY KRANE, PH.D., BRUCE MENGE, PH.D., JONATHAN ROUGHGARDEN, PH.D., EDNA SEAMAN, PH.D., Assistant Professors of Biology; VORSILA BOHRER, PH.D., PRISCILLA DOFF, B.S., Lecturers in Biology.

COLLEGE II

JOHN A. FREEBERG, PH.D., Associate Professor of Biology and Chairman of Biology, College II; NEVIN WEAVER, PH.D.,

Professor of Biology; RUTH R. BENNETT, PH.D., Associate Professor of Biology; STUART W. BRADFORD, PH.D., ELIZABETH A. DAVIS, PH.D., LORRAINE L. LARISON, PH.D., MARTHA (BETHELL) MATEO, PH.D., KENNETH NEALSON, PH.D., JOHN SCHULTZ, PH.D., CLAIRE VAN UMMERSEN, PH.D., H. GARRISON WILKES, PH.D., Assistant Professors of Biology; RICHARD STONE, M.A., WESLEY TIFFNEY, M.S., Instructors in Biology.

GRADUATION REQUIREMENTS

All students who major in biology take certain basic courses in science and mathematics, but should recognize that there are different ways to complete the major.

Majors may take Biology 101-102, one year of Chemistry for science majors, one year of Physics, one year of Mathematics, preferably calculus, and three 2-semester courses in advanced biology (211-2, 241-2, 271-2).

In place of one of the three advanced biology courses, equivalent credits in advanced chemistry, especially organic or physical chemistry, or in advanced physics or mathematics may be presented. Students must consult with their major adviser to determine which of the advanced courses to be taken outside of the Biology Department are acceptable.

EXEMPTION FROM INTRODUCTORY BIOLOGY

Students may satisfy the Biology Department majors requirement for elementary biology (Biology 101-102 or 101-104) and/or one year of the natural sciences core requirement through a special qualification program in Biology. Interested students who have a strong background in secondary school biology should 1) contact the Biology Department for an interview and 2) take a written examination in biology to be offered prior to registration for the fall term. On the basis of the interview and the examination the student may be granted exemption from Biology 101 and 102 or Biology 101-104.

COURSE OFFERINGS

(3 hours, 3 credits each, unless specified)

101 (I) GENERAL BIOLOGY

An integrated course stressing the principles of biology. Life examined at the molecular, cellular, organismal and population level and structure considered in relation to function of biological principles. Emphasis on evolution as the major unifying principle of biology.

3 hours lecture, 3 hours laboratory, 4 credits
Staff

102 (II) GENERAL BIOLOGY

Continuation of Biology 101, intended for students majoring in biology and other natural sciences.

3 hours lecture, 3 hours laboratory, 4 credits
Prerequisite: Biology 101
Staff

104 (II) HUMAN BIOLOGY

Continuation of Biology 101, intended for non-science majors. Genetics, evolution, physiology and population biology of the human organisms. Biological aspects of current social problems.

3 hours lecture, 3 hours laboratory and discussion, 4 credits
Prerequisite: Biology 101
Staff

211 (I), 212 (II) BIOLOGY OF ORGANISMS

The major group of protists, plants and animals studied to elucidate the principles of reproduction, growth, development, maintenance, integration and responses to the environment.

3 hours, 6 hours laboratory, 5 credits
Prerequisite: Biology 102
Staff

213 (I), 214 (II) BIOLOGY OF ORGANISMS LECTURE

The lecture portion of Biology 211-212.
Prerequisite: same as Biology 211, 212
Staff

241 (I) BIOLOGY OF POPULATIONS

Principles of heredity in animals (including man) and plants, cytogenetics and population genetics. Introduction to natural selection and evolution; speciation of animals. Field trips, laboratory experiments in genetics, introduction to statistics and computers. 3 hours lecture, 6 hours laboratory, 5 credits
Prerequisite: Biology 102 or permission of instructor.
Staff

242 (II) BIOLOGY OF POPULATIONS

A continuation of Biology 241. Mechanisms

of speciation in plants. Population ecology: Mathematical theory and examples of population dynamics of competition, predation, and other population interactions. (Knowledge of calculus helpful but not required.) Ecology of biological communities: community structure (e.g., trophic webs, energy flow, species diversity, succession) and control mechanisms. Biogeographical theory and pattern. Individual field and/or laboratory projects, class field trips.
3 hours lecture, 6 hours laboratory, 5 credits
Prerequisite: Biology 241 or permission of instructor Staff

243 (I) BIOLOGY OF POPULATIONS LECTURE
The lecture portion of Biology 241.
Prerequisite: same as Biology 241 Staff

244 (II) BIOLOGY OF POPULATIONS LECTURE
The lecture portion of Biology 242.
3 credits
Prerequisite: Biology 241 or 243 or permission of instructor Staff

271 (I), 272 (II) BIOLOGY OF CELLS
The cytology and fine structure of cells in relation to the production of energy for growth and reproduction. The chemistry of the life process considered in detail as a tool for inquiry into current problems in biology. The specialization of cells and their integration in tissues.
3 hours lecture, 6 hours laboratory, 5 credits
Prerequisite: Biology 102, Chemistry 153-154 or 155-156. Chemistry 153 or 155 may be taken simultaneously with Biology 271. This last requirement may be waived in unusual circumstances with the consent of the staff. Staff

273 (I), 274 (II) BIOLOGY OF CELLS LECTURE
The lecture portion of Biology 271-272.
Prerequisite: same as Biology 271-272. Staff

350 FIELD BIOLOGY ON NANTUCKET (Summer)
Requires written reports on original research projects on the field biology of Nantucket Island. Meets each weekday from late July through August at the University's Research Center on Nantucket. Lectures, seminars and individual consultations arranged. Mainland

students live at the Center and are responsible for modest expenses.
6 credits
Prerequisite: Biology 102 and permission of instructor Staff

351 (I), 352 (II) SPECIAL TOPICS
Detailed study of a specialized field of biology. Several topics may be offered each semester.
1 hour, 1 credit
Prerequisite: Permission of instructor Staff
386 (I, II) METHODS AND PRACTICE TEACHING OF BIOLOGY IN SECONDARY SCHOOLS

The issues, principles and methods of teaching Biology in the schools. Supervision and critique of practice teaching. Biology majors are advised to check scheduling practice teaching with department.
3 hours, 20 hours laboratory (practice teaching), 9 credits
Prerequisite: 6 hours Education courses and admission to Teacher Certification Program Staff

390 (I), 391 (II) INDEPENDENT STUDY

Laboratory or library research under the guidance of a faculty adviser, resulting in a thesis presented to the Biology staff. Usually taken by candidates for honors in biology and other qualified students who meet departmental requirements for independent study. Interested students should apply to the Honors and Special Courses Committee of the Biology Department during the middle of the second semester of their Junior year.
1 to 3 credits
Prerequisite: Cumulative average of 2.5 or better; completion of at least two semesters of one of the advanced biology courses with a 3.0 average or better Staff

CHEMISTRY COLLEGE I

THOMAS N. MARGULIS, PH.D., Associate Professor of Chemistry and Chairman of Chemistry, College I; ERNEST I. BECKER, PH.D., Professor of Chemistry; HANS VAN WILLIGEN, PH.D., Associate Professor of Chemistry; JOSEPH S. ALPER, PH.D., JOSEPH E. KNOLL, PH.D., WALTER E. WEIBRECHT, PH.D., Assistant Professors of Chemistry; FREDERICK W. SNYDER, JR., B.S., Lecturer in Chemistry.

COLLEGE II

LEVERETT J. ZOMPA, PH.D., Associate Professor of Chemistry and Chairman of Chemistry, College II; J.-P. ANSELME, PH.D., CHI-HUA WANG, PH.D., Professors of Chemistry; ROBERT I. GELB, PH.D., DANIEL A. LAUFER, PH.D., LOWELL M. SCHWARTZ, SC.D., Associate Professors of Chemistry; H. MICHAEL WIDMER, PH.D., Assistant Professor of Chemistry; KENNETH CERNY, B.S., Instructor in Chemistry.

GRADUATION REQUIREMENTS

Chemistry majors will take a basic group of courses in chemistry, mathematics and physics which will satisfy usual requirements appropriate to preprofessional training in chemistry or teaching or to certain interdisciplinary fields of study.

All majors in chemistry are required to take Chemistry 103-04, 153-54, 213-14, 321, 370; Mathematics 105-06; and Physics 111-12. Students intending graduate study in chemistry should elect German or Russian to fulfill their language requirement and should take 4 courses among advanced chemistry courses, physics beyond 112, or mathematics beyond 106. Also, such students are strongly urged to take Thesis 397-98. Students with interest in the life sciences, including medicine, may select appropriate biology courses and/or biochemistry. Students interested in the teacher certification program should begin their teacher training courses in the junior year as part of their distribution options.

COURSE OFFERINGS

(3 hours, 3 credits each, unless specified)

101 (I, II) CHEMICAL SCIENCE I

First semester of a one-year introductory course for non-science majors. The basic principles of atomic structure, molecular structure and chemical change. Topics include atomic theory, the periodic table, chemical bonding and thermochemistry.

3 hours lecture, 1 hour recitation, 4 credits

Mr. Margulis, Mr. Weibrecht and Staff

102 (II) CHEMICAL SCIENCE II

Systematic descriptive chemistry and the chemistry of biological substances.

3 hours lecture, 1 hour recitation, 4 credits

Prerequisite: Chemistry 101

Mr. Margulis, Mr. Weibrecht and Staff

103 (I, II) CHEMICAL PRINCIPLES I

Introduction to the fundamental principles of chemistry including structure, the periodic table of the elements, chemical bonding and molecular structure, states of matter based on kinetic theory, chemical kinetics, equilibria, and elementary thermodynamics. Laboratory work presents an introduction to methods of quantitative chemical techniques.

2 hours lecture, 1 hour recitation

3 hours laboratory, 4 credits

Mr. Zompa and Staff

104 (II) CHEMICAL PRINCIPLES II

Introduction to electrochemistry, oxidation-reduction reactions, acid-base systems, and a survey of the chemical properties of elements based on principles already introduced. Laboratory work presents qualitative and quantitative analysis.

2 hours lecture, 1 hour recitation

3 hours laboratory, 4 credits

Prerequisite: Chemistry 103

Mr. Zompa and Staff

153 (I), 154 (II) ORGANIC CHEMISTRY

An intensive survey of the synthesis and properties of the main classes of organic compounds including mechanistic discussions of their reactions. Laboratory illustrates the preparation, purification and identification of organic compounds by classical experimental methods with an introduction to modern purification, analytical and instrumental techniques.

3 hours, 3 hours laboratory, 4 credits

Prerequisite: Chemistry 104 Mr. Wang

155 (I), 156 (II) INTRODUCTION TO ORGANIC CHEMISTRY

A survey of the synthesis and properties of the main classes of organic compounds including mechanistic discussions of their reactions. Special topics in natural products and processes Laboratory same as Chemistry 153-154. Primarily for Biology majors.

3 hours, 3 hours laboratory, 4 credits

Prerequisite: Chemistry 104 Mr. Becker

213 (I), 214 (II) PHYSICAL CHEMISTRY AND LAB

The fundamental theories and laws of physical chemistry. Topics include states of matter, thermodynamics, phase equilibria, the structure of matter, and chemical kinetics.

Laboratory work illustrates lecture principles and provides practice in modern physical-chemical methods of experimentation.

3 hours, 3 hours laboratory, 4 credits

Prerequisite: Chemistry 104, Math 106, Physics 112; Chemistry 213 before 214

Mr. Alper, Mr. Knoll

217 (I) PHYSICAL CHEMISTRY FOR BIOLOGY MAJORS

Principles of physical chemistry for advanced work in Biology and Biochemistry. Emphasis on equilibrium processes based on thermodynamic fundamentals and on the principles of rate processes.

Prerequisite: Chemistry 104, Physics 102 or 112, Mathematics 105. NOTE: Credit cannot be received for both Chemistry 213-214 and Chemistry 217.

Mr. Schwartz

315 (I) TOPICS IN PHYSICAL CHEMISTRY

Topical discussions, each based on elementary principles studied in Chemistry 213-14 and progressing toward recent developments in the field.

Prerequisite: Chemistry 214

Physical Chemistry Staff

321 (I) ANALYTICAL CHEMISTRY

Detailed discussion of chemical equilibrium. Analytical applications of electrometric, chromatographic, and spectrometric methods. 2 hours, 6 hours laboratory, 4 credits

Prerequisite: Chemistry 104

Mr. Gelb and Mr. Widmer

351 (I) ORGANIC QUALITATIVE ANALYSIS

Theory and practice in organic compound separation and identification employing classical and instrumental methods.

1 hour lecture, 6 hours laboratory, 3 credits

Prerequisite: Chemistry 154 or 156

Mr. Anselme

354 (II) INTRODUCTORY BIOCHEMISTRY

Structure, chemistry and metabolism of nucleic acids, proteins and carbohydrates.

Prerequisite: Chemistry 154 or 156 or equivalent

Mr. Laufer

355 (I) TOPICS IN ORGANIC CHEMISTRY

Senior-level discussion of selected topics in organic chemistry.

Prerequisite: Chemistry 154

Corequisite: Chemistry 351

Mr. Anselme, Mr. Becker, Mr. Laufer,

Mr. Wang

361 (II) ANALYTICAL INSTRUMENTATION

Principles and use of instrumental methods in analysis. Topics in electronics, electrochemistry, spectroscopy, flamephotometry, mass spectrometry, NMR.

3 hours, 3 hours laboratory, 4 credits

Prerequisite: Chemistry 214

Mr. Gelb

370 (II) INORGANIC CHEMISTRY

Discussion of the fundamental principles of modern inorganic chemistry. Laboratory includes synthetic techniques and methods of characterization of inorganic compounds.

2 hours, 6 hours laboratory, 4 credits

Prerequisite: Chemistry 104, 154, and either 213 or 217

Mr. Carter, Inorganic Staff

395 (I), 396 (II) ADVANCED LABORATORY IN CHEMISTRY

Special laboratory topics in chemistry.

12 hours laboratory, 4 credits

Prerequisite: Chemistry 214

Staff

397 (I), 398 (II) SENIOR THESIS IN CHEMISTRY

Original investigation by the student under the guidance of a faculty adviser. An oral resumé before the Chemistry staff is required. 12 hours laboratory, 4 credits

Prerequisite: Chemistry 214

Staff

RELATED COURSE

PHYSICAL SCIENCE 386 METHODS AND PRACTICE TEACHING OF PHYSICAL SCIENCE IN SECONDARY SCHOOLS

MASTER'S DEGREE PROGRAM

701 (I) CHEMICAL DYNAMICS I

Discussions and outside readings in the areas of chemical and physical equilibria and rate processes. Emphasis on thermodynamics from classical and statistical points of view and on chemical reaction mechanisms.

702 (II) CHEMICAL DYNAMICS II

Three or four selected topics of interest to students and staff involved. Typical subjects: molecular transport processes and the kinetic theory; photochemistry and excitation transfer processes; surface and electrode rate processes; particle collision dynamics and reactivity; irreversible thermodynamics; interaction of radiation and matter; and molecular state transitions.

Staff

711 (I) CHEMICAL STRUCTURE I

Structure determination and theory. Three or four molecules of interest to the students

and faculty involved are chosen. Based on these molecules, discussions, readings and laboratory exercises attempt to show how a chemist determines each structure and how the structure is understood by modern chemical theory.

3 hours class and laboratory Staff

712 (II) CHEMICAL STRUCTURE II

In tutorial form. Individual students study advanced structure topics with appropriate staff members. Staff

721 (I) CHEMICAL SYNTHESIS I

The tactics and strategy of accomplishing the synthesis of a chemical substance. Examples of organic and inorganic systems. Staff

722 (II) CHEMICAL SYNTHESIS II

The synthesis and characterization of a number of representative organic and inorganic compounds.

6 hours laboratory Staff

900 MASTER'S THESIS

10 credits maximum Staff

925 (I), 926 (II) SEMINAR

1 credit Staff

CLASSICS

COLLEGE II

GEORGE KONIARIS, PH.D., Associate Professor of Classics and Chairman of Classics, College II; RENETA POGGIOLI, PH.D., Associate Professor of Classics; ANNE MICHELINI, PH.D., Assistant Professor of Classics; BLAISE NAGY, M.A., FRANK J. NISETICH, M.A., JOHN SHEA, M.A., ROSEMARY B. TOBIN, M.A., Instructors in Classics.

GRADUATION REQUIREMENTS

Classics Major

Students majoring in Classics are expected to have a total of 30 credits; two courses each in Greek and Roman literature, plus Greek 241-42, and Classics 331-32 or its equivalent.

It is recommended that all majors in the Classics Department elect two courses in Ancient History or Greek Philosophy, or Greek and Roman Art, according to their objective.

At the end of their Senior year, students will take a General Examination on language proficiency and in a chosen field of literature.

A student standing for honors may choose to write an honors thesis on a subject approved by an instructor (see Classics 261).

Greek Major

Students majoring in Greek are expected to have a minimum of 24 credits in Junior-Senior level courses: four courses in Greek Literature, two in Greek Composition and two in Classics 331-332 or its equivalents (2 semesters of Ancient History or 2 semesters of Ancient History of Art). They will also have to take at least one year of the Latin language. This minimum of 24 units will be equal to eight courses. Requirements for the Greek major are: 2 semesters Greek Composition (GR 241-242); 4 semesters Greek Literature (GR 231-232, GR 233-234, GR 235-236); 2 semesters of Greek and Roman Civilization (CL 331-332) or 2 semesters Ancient History or 2 semesters Ancient History of Art (the latter two courses are taught by the History Department and the Art Department respectively); 2 semesters Elementary Latin (LA 111-112).

Latin Major

Students majoring in Latin are expected to have a minimum of 24 credits in Junior-Senior level courses (four courses in Literature, two in Composition, two in Classics 331-32 or its equivalent). They are also required to take at least one year of the Greek language, preferably in their Freshman-Sophomore years.

COURSE OFFERINGS

(3 hours, 3 credits each, unless specified)

CLASSICS IN TRANSLATION

111 GREEK AND ROMAN EPIC POETRY

Lectures on the Greek and Roman epics with

reading and class discussion of *Iliad*, *Odyssey*, and *Aeneid*.

3 hours, 4 credits

Prerequisite: Sophomore standing

Mr. Nisetich

112 GREEK AND ROMAN RELIGION AND MYTHOLOGY

An introduction to the study of Greek and Roman religion and mythology and emphasis on the Greek and Roman myths and legends that have an important place in European and American literature and art.

3 hours, 4 credits

Prerequisite: Sophomore standing

Mr. Nisetich

121 GREEK AND ROMAN TRAGEDY

Lectures on Greek and Roman tragic drama with readings and class discussion of plays of Aeschylus, Sophocles, Euripides, and Seneca.

3 hours, 4 credits

Prerequisite: Sophomore standing

Mr. Nisetich

122 GREEK AND ROMAN COMEDY

Lectures on Greek and Roman comic drama with readings and class discussions of the plays of Aristophanes, Menander, Plautus, and Terence.

3 hours, 4 credits

Prerequisite: Sophomore standing

Mr. Nisetich

261, 262 HONORS THESIS

A substantive review of a subject approved by the individual instructor.

6 credits

Prerequisite: permission of department and sophomore standing

Staff

331 (I), 332 (II) GREEK AND ROMAN CIVILIZATIONS

A survey of the literature, philosophy and art of Greece and Rome in their historical setting. All readings in English.

3 hours, 4 credits

Prerequisite: Sophomore standing

Mrs. Poggioli

386 METHODS AND PRACTICE TEACHING OF LATIN IN SECONDARY SCHOOLS

The issues, principles and methods of secondary school teaching of Latin. Supervision and critique of practice teaching.

3 hours, 20 hours laboratory (practice teaching), 9 credits

Prerequisite: 6 hours Education courses and admission to Teacher Certification Program

Mrs. Tobin

392 WOMEN IN GREEK AND ROMAN LITERATURE; REFLECTIONS OF A DIVIDED SOCIETY

Readings in English translation of works of Greek and Roman literature dealing with women and their place in society.

3 hours, 4 credits

Prerequisite: Sophomore standing

Mrs. Michelini

394 LITERARY CRITICISM IN ANTIQUITY

Readings in English translation of works of Greek and Roman literature dealing with criticism.

3 hours, 4 credits

Prerequisite: Sophomore standing

Mrs. Michelini

398 INDEPENDENT STUDY

Selected research topics organized in consultation with individual students.

3 credits, weekly conferences

Prerequisite: Permission of instructor and Department Chairman

GREEK

111 (I), 112 (II) ELEMENTARY GREEK

Fundamentals of the Greek language.

3 hours, 4 credits

Staff

121 (I), 122 (II) INTERMEDIATE GREEK

Continued study of grammar and syntax. Readings include Plato's *Apology* and selections from other dialogues and from Homer's *Iliad*.

3 hours, 4 credits

Prerequisite: Greek 112 or equivalent

Staff

231 (I), 232 (II) INTRODUCTION TO GREEK LITERATURE

Plato and the Greek Tragedians.

Prerequisite: Greek 121-122

Staff

233 (I), 234 (II) GREEK LITERATURE

Attic Orators: selections from Antiphon and Demosthenes; selections from Lysias and Isaeus.

Prerequisite: Greek 122

Staff

235 (I), 236 (II) GREEK LITERATURE

Greek Historians: selections from Herodotus and Xenophon; selections from Thucydides.
Prerequisite: Greek 122 Staff

241 (I), 242 (II) ADVANCED GREEK READING AND COMPOSITION

Review of Greek syntax; reading of literary works with a stress on dialectical differences. Translation from English and original composition.

Prerequisite: Greek 122 or equivalent Staff

LATIN

111 (I), 112 (II) ELEMENTARY LATIN

For students who have no creditable training in Latin. Intensive practice in language skills with introductory readings.

3 hours, 4 credits Staff

121 (I), 122 (II) INTERMEDIATE LATIN

Review of reading skills. Selective readings in Latin literature.

3 hours, 4 credits

Prerequisite: Latin 112 or equivalent Staff

231 (I), 232 (II) LATIN LITERATURE

Intensive readings of masterpieces of Latin literature, including epic poetry (Virgil), Catullus, and the Elegiacs.

Prerequisite: Latin 122 or equivalent Staff

233 (I), 234 (II) LATIN LITERATURE

Intensive study of Ovid's *Metamorphoses* and Tacitus' *Annals*.

Prerequisite: Latin 232 or equivalent Staff

235 (I), 236 (II) LATIN LITERATURE

Intensive study of Lucretius' *De Rerum Natura*, Cicero's *The Philosophical Work*.

Prerequisite: Latin 232 or equivalent Staff

237 (I), 238 (II) LATIN LITERATURE

Horace's *Odes* and *Satires*, and readings in the Roman Theatre, including works by Plautus, Terence and Seneca.

Prerequisite: Latin 232 or equivalent Staff

240 (II) LATIN LITERATURE: ROMAN SATIRE

Reading of selected satires of Juvenal, epigrams of Martial together with an analysis of *Cena Trimalchionis*, *Ludus de Morte Claudii* and selected inscriptions.

Prerequisite: Latin 122 or equivalent

Mrs. Tobin

241 (I), 242 (II) LATIN COMPOSITION

Composition; review of Latin syntax and structure; translations from English and original compositions.

Prerequisite: Latin 122 or equivalent Staff

ECONOMICS

COLLEGE I

LEONARD KIRSCH, PH.D., Assistant Professor of Economics and Chairman of Economics, College I; SALVATORE SCHIAVO-CAMPO, PH.D., Associate Professor of Economics; LOUIS ESPOSITO, PH.D., DAVID PODOFF, PH.D., Assistant Professors of Economics; JOHN A. TILLMAN, M.S., Instructor in Economics.

COLLEGE II

RAYMOND G. TORTO, PH.D., Assistant Professor of Economics and Acting Chairman of Economics, College II; HAROLD WOLOZIN, PH.D., Professor of Economics; MONIQUE P. GARRITY, PH.D., DANIEL A. PRIMONT, PH.D., Assistant Professors of Economics.

GRADUATION REQUIREMENTS

All Economics majors are required to take Economics 141, 155 and 215-216 and 18 additional credits of Junior-Senior level courses. However, by permission of the Department up to 6 credits in related disciplines may be substituted for Economics courses. It should be noted that Economics 131 and Economics 263 are not considered to be Junior-Senior level courses.

Majors planning to go on to graduate study are advised to take Economics 251 and 252.

Majors with a cumulative average of at least 3.0 in both their overall work and in their major can, with the approval of the department, participate in an Honors Program (see Economics 390). Successful completion of the program will entitle the student to graduate with Honors in Economics.

COURSE OFFERINGS

(3 hours, 3 credits each, unless specified)

131 (I, II) ACCOUNTING PRINCIPLES AND APPLICATIONS

A survey of the principles of accountancy with emphasis on their practical applications.

3 hours, 4 credits

Staff

141 (I, II) ECONOMIC LITERACY

A broad introductory survey of economic principles and institutions. Emphasis on the role of economic principles in understanding and analyzing current economic problems.

3 hours, 4 credits

Staff

155 (I, II) STATISTICAL METHODS

A non-calculus introduction to statistical analysis as a tool for decision-making in the social sciences. Descriptive statistics and statistical inference; emphasis on fundamental concepts and methods.

3 hours, 4 credits

Prerequisite: Mathematics 102 or equivalent

Staff

213 (I, II) THE ECONOMICS OF URBAN PROBLEMS

An economic analysis of urban areas and "urban problems." Emphasis on such problems as industrial and job location, poverty, residential migration and housing, transportation, and public finance among others.

Prerequisite: Economics 141

Mr. Torto

214 (I) RESEARCH IN URBAN PROBLEMS

The central problems of the megalopolis and the evolving techniques of coping with them.

Prerequisite: Economics 141

Staff

215 (I, II) ECONOMIC THEORY I: MACROECONOMICS

Analysis of the forces determining the level and structure of gross national output, and those government policies which attempt to affect economic activities in the United States.

Prerequisite: Economics 141

Staff

216 (I, II) ECONOMIC THEORY II: MICROECONOMICS

Analysis of consumer behavior, the theory of production, equilibrium of the firm and the industry, market structures, and the pricing of factors of production.

Prerequisite: Economics 141

Staff

217 (I) THE ECONOMICS OF THE PUBLIC SECTOR: PROBLEMS IN PUBLIC FINANCE

The incidence and effects of taxation, gov-

ernment expenditure programs, and public debt operations of Federal, State and local governments.

Prerequisite: Economics 215

Mr. Podoff

230 (I) THE ECONOMICS OF MONEY

The demand and supply of money and its effects on the American economy. Special emphasis will be put on Federal Reserve control of the supply of money through the commercial banking system. The implementation and efficacy of monetary policy and the debate between the monetarists and fiscalists will be studied.

Prerequisite: Economics 215

Mr. Torto

232 (I) INDUSTRIAL ORGANIZATION

A theoretical framework for the analysis and evaluation of the performance of American industry; examination of a group of American industries to illustrate usefulness of economic theory in explaining price and output policy; analysis of antitrust activities as a public policy designed to promote better market performance.

Prerequisite: Economics 216

Mr. Esposito

235 (I) INTERNATIONAL ECONOMICS

The theory of international trade; theory and practice of commercial policy; international finance: the balance of payments, adjustment mechanisms, and alternative monetary systems.

Prerequisite: Economics 141

Mrs. Garrity, Mr. Schiavo-Campo

236 (II) ECONOMIC DEVELOPMENT

The economic meaning of underdevelopment; evaluation of alternative "strategies" for economic growth; the role played by different kinds of resources; interaction of the problems of the underdeveloped countries of Africa, Asia, and Latin America with the policies of the developed countries.

Prerequisite: Economics 141

Mrs. Garrity, Mr. Schiavo-Campo

237 (II) THE AFRICAN ECONOMY

Comparative analysis of the economic characteristic problems of sub-Sahara Africa.

Prerequisite: Economics 141

Mrs. Garrity

243 (II) ECONOMIC PROBLEMS AND PROSPECTS FOR BLACK AMERICA

Analysis of the economic problems confronting Black Americans with emphasis on ways and means of resolving them.

Prerequisite: Economics 141

Mrs. Garrity

245 (II) INCOME DISTRIBUTION

The economics of the size distribution of income.

Prerequisite: Economics 141 Staff

247 (II) ECONOMICS OF SOCIAL AND HUMAN RESOURCES

The development of social and human resources in an economy and the relationship between private and public sectors. General survey of public expenditure criteria, cost benefit analysis and the balance between social and private capital in a mixed economy.

Prerequisite: Economics 141 Staff

249 (I) POLLUTION AND THE QUALITY OF LIFE

An introductory survey of the impact of economic activity upon the environment and the quality of life in our society: the sources, measurement, and control of pollution as a problem in private and social planning. Legal, social, political, and psychological factors.

Prerequisite: Economics 141 Mr. Wolozin

251 (II) MATHEMATICAL ECONOMICS

Static and dynamic models of economic behavior will be formulated.

Prerequisite: Mathematics 106 or equivalent; Economics 215-216 Mr. Primont

252 (I) ECONOMETRICS

The traditional simple and multiple linear regression models. Application of these models to estimating both microeconomic and macroeconomic relationships.

Prerequisite: Economics 155 Mr. Tillman

263 (I) INTRODUCTION TO DATA PROCESSING

A rigorous introduction to data processing emphasizing the mathematical and theoretical fundamentals of data processing, illustrated with examples drawn from current data processing projects. Stresses mathematical and logical concepts useful in the social sciences and management.

Prerequisite: Mathematics 102 or equivalent Staff

272 (II) COMPARATIVE ECONOMIC SYSTEMS

Relationship between market and non-market mechanisms in the production and distribution of economic resources in four economies. First half devoted to analysis of contemporary American capitalism, the British economy under Labor Government 1945-

1950, and the German economy of 1934-1945. Second half concentrates on planned economy of the U.S.S.R.

Prerequisite: Economics 141 Mr. Kirsch

281 (II) MARXIST ANALYSIS AND RADICAL CRITIQUES OF MODERN ECONOMIC THEORY

The central focus of the course is Marxist economic analysis in its "classical" and "modernized" forms. Radical critiques of standard "macro", "micro", and "development" economic theory are presented and evaluated.

Prerequisite: Economics 141 Mr. Kirsch

291 (II) ECONOMICS OF LABOR AND COLLECTIVE BARGAINING

History of labor in the United States. The economic theory of wage determination and collective bargaining.

Prerequisite: Economics 141 Mr. Kirsch

313 (II) PERSPECTIVES ON HOUSING IN THE U.S.

History and analysis of major economic and social factors affecting housing in the U.S. as a process. Emphasis on understanding issues and principles which influence decision-making in industry and at various levels of the government.

Prerequisite: Economics 213 Staff

316 (II) MONETARY AND FISCAL POLICY

Analysis and evaluation of the tools of monetary and fiscal policy and their effectiveness in stabilizing economic activity.

Prerequisite: Economics 215 Mr. Podoff

349 (II) SEMINAR IN THE ECONOMICS OF ENVIRONMENTAL CONTROL

Research and reading in selected topics related to environmental control: social costs, quality of the environment, economics and the law, population, economic growth, interdisciplinary approaches, etc.

Prerequisite: Economics 249 or permission of instructor Mr. Wolozin

381 (I, II) INDEPENDENT STUDIES

Research and reading in any area in Economics: the purpose of this course is to allow the student to do advanced work in an area of Economics to which he has already been exposed or to investigate an entirely new area.

Prerequisite: Permission of instructor Staff

382 (I, II) SEMINAR

A Senior Seminar conducted by various members of the faculty with concentration on their fields of scholarly interest.

Prerequisite: Permission of instructor

Staff

390 (II) HONORS THESIS

Senior Economics majors who have at least a 3.0 grade point average both overall and in their major can, with the approval of the department in the spring semester of their senior year, write an Honors thesis under the direct supervision of a member of the department. The thesis adviser will be chosen by the student and the nature of the research project will be agreed upon by both student and adviser. The thesis adviser and the student will then select a "reader" who will be available for consultation through the term of the project. Upon completion of the thesis, it will be submitted to the department chairman who will schedule an oral resumé before the Economics Department. The grade for the course and the awarding of honors will be determined by the thesis adviser and reader.

Staff

ENGLISH

COLLEGE I

JAMES H. BRODERICK, PH.D., Associate Professor of English and Chairman of English, College I; MAX BLUESTONE, PH.D., FRANCIS RUSSELL HART, PH.D., Professors of English; ALBERT MURRAY, M.A., Visiting Professor of English; JOEL BLAIR, PH.D., CHARLES A. CAMPBELL, PH.D., MARY ANNE FERGUSON, PH.D., KENNETH FREDERICK, PH.D., SEYMOUR KATZ, PH.D., CHARLES KNIGHT, PH.D., DOROTHY S. MULL, PH.D., FREDERICK WILLEY, PH.D., Associate Professors of English; ANN BERTHOFF, M.A., Part-time Associate Professor of English; DONALD BABCOCK, PH.D., ALAN E. HELMS, PH.D., RONALD SCHREIBER, PH.D., LINDA SLOTNICK, PH.D., GEORGE SLOVER, PH.D., GEORGE W. SMITH, JR., PH.D., JOSEPH TRIBBLE, PH.D., LEE ALLEN WARREN, PH.D., Assistant Professors of English; RICHARD HORSLEY, A.B., S.T.B., CAROLE ROBINSON, PH.D., Part-time Assistant Professors of English; CHARLES BOWEN, M.A., ALBERT

DIVVER, M.A., CHRISTOPHER GAY, M.A., MONICA MCALPINE, M.A., WILLIAM SANDERS, M.A., Instructors in English; ROBERTA HENDRICKSON, M.A., Part-time Instructor in English; ANITA ANGER, M.A., FRANK BIDART, M.A., GARY HUNT, M.A., EMILY MEYER, M.A., DOROTHY SHUKRI, A.G.S.M., JOSEPH WILLIAMSON, S.T.M., PH.D., Part-time Lecturers in English.

COLLEGE II

RICHARD S. LYONS, PH.D., Associate Professor of English and Chairman of English, College II; MARY CURRAN, PH.D., EMERSON R. MARKS, PH.D., ALVIN S. RYAN, PH.D., Professors of English; WARREN CHERNAIK, PH.D., PHILIP FINKELPEARL, PH.D., EDWIN GITTLEMAN, PH.D., JOHN MARVIN, M.A., ROBERT RISSE, PH.D., Associate Professors of English; NINA ALONSO, PH.D., MARJORIE COLLINS, PH.D., MARY EDWARDS, PH.D., MARTHA FINNEY, PH.D., JAMES LELAND GROVE, PH.D., KATHRYN KREMEN, PH.D., RICHARD MORAHAN, PH.D., DUNCAN NELSON, PH.D., SHAUN O'CONNELL, PH.D., THEODORE RICHER, M.F.A., ROSAMOND ROSENMEIER, PH.D., JAMES G. SWEENEY, PH.D., CORNELIA VEENENDAAL, M.A., IGOR WEBB, PH.D., Assistant Professors of English; RENATA MAUTNER, M.A., OTTO VAN OS, M.A., Instructors in English; LOUIS G. BOND, M.A., LINDA HUNT, M.A., CARL SENNA, JUDITH VARGAS-VILA, M.A., Part-time Lecturers in English.

GRADUATION REQUIREMENTS

Students majoring in English are expected to choose courses that best satisfy their own interests and needs, and to fulfill, in a sequence of their own devising, a minimum requirement of 10 English courses beyond freshman English, at least six of which must be above the sophomore level. All English majors are advised to study foreign languages; those planning to go to graduate school should develop a reading knowledge of at least one foreign language. In planning their program, English majors must obtain as-

sistance from their departmental advisers; they may also seek assistance from the officers and associates of the four departmental Conferences.

These Conferences bring together students and faculty with common interests to discuss the department's course offerings and other topics of concern to students of English. Students will be helped by the Conference to choose courses that best fulfill their own educational objectives. They will also join with the faculty in suggesting to departmental committees new developments in the program of English courses. In addition, each Conference will sponsor lectures and discussions in the area of its own interests. While participation in a Conference is not required, students are strongly recommended to associate with one or more Conferences.

Conference I: English and American Literature: The Tradition

For students who wish to explore the range and tradition of English and American Literature as they appear in major periods, genres, and writers. Such students should take English 201 and 202 as a preliminary survey of the whole field.

Conference II: Special Topics

For students who wish to explore some special topic within the field of English and American Literature. Such students will be helped to plan programs which combine courses in the field of their special interest with related courses outside it.

Conference III: Creative Writing

For students primarily interested in creative writing. Such students will be helped to plan programs which include, along with creative writing, appropriate courses in literature and criticism. Note that permission of the instructor is required for admission to creative writing courses.

Conference IV: American Literature

For students interested in American Lit-

erature and American Studies. The Conference assists students in exploring the following kinds of courses: American Literature in its Cultural Context, American Ethnic and Regional Literature, Form in American Literature, and Selected American Authors. The Conference will also offer guidance in the selection of related courses offered by other departments.

ADVANCED PLACEMENT

Students earning a grade of 5 on the Advanced Placement Examination in English are granted 8 credits toward graduation and exemption from English 101-02. Students earning a grade of 3 or 4 may be awarded credit or exemption at the discretion of the department.

COURSE OFFERINGS

(3 hours, 3 credits each, unless specified)

005 WRITING, THINKING, AND SELECTED READINGS

Practice in critical reading, writing, and thinking through the study of materials from historical, scientific, sociological, and literary sources. Minimum of eight papers.

Prerequisite: Permission of Director, Special Admissions Summer Program. No credit. Provision for exemption and credit in English 101.

010 (I, II) ENGLISH COMPOSITION

Experimental approaches to composition in a limited number of small sections. Staff

100 (I) ENGLISH AS A SECOND LANGUAGE

The mechanics of written English; selected reading; one written theme each week; individual conferences. Open only to students assigned in advance of registration. Course credit only to students who pass the intermediate examination in their own language administered by the Educational Testing Service, or its equivalent as determined by the appropriate department.

3 hours, 4 credits

Mr. Van Os

101 (I), 102 (II) FRESHMAN ENGLISH

A year's practice in writing argument, exposition, and other forms of English prose. Readings and materials are chosen by instructors to focus experience and provoke reflection and debate, as well as to exemplify

qualities of writing essential to effective self-expression. A minimum of eight papers the first semester, seven the second.

3 hours, 4 credits

Staff

GROUP I: INTRODUCTIONS TO LITERARY STUDIES: RECOMMENDED FOR SOPHOMORES

111 (I, II) ORIGINS OF THE MODERN PERIOD

Readings primarily in the major literature of the nineteenth century in a variety of genres. Works by such authors as Blake, Wordsworth, Thoreau, Melville, Dickens, Dostoevsky, Ibsen, and Chekhov. Special attention to writing.

3 hours, 4 credits

Prerequisite: English 102

Mr. Frederick, Mrs. Hunt, Mr. Stock

112 (I, II) TWENTIETH-CENTURY MASTERPIECES

Readings primarily in the major literature of the twentieth century in a variety of genres. Works by such authors as Yeats, Eliot, Joyce, Faulkner, Mann, Gide, Lawrence, Brecht, and Beckett. Special attention to writing.

3 hours, 4 credits

Prerequisite: English 102

Mrs. Alonso, Mrs. Collins, Mr. Schreiber,
Mrs. Veenendaal

113 (I, II) INTRODUCTION TO SHAKESPEARE

A one-semester introduction to Shakespeare's art through the study of a representative group of his plays. Special attention to writing.

3 hours, 4 credits

Prerequisite: English 102

Mr. Chernaik, Mr. Divver, Mr. Slover,
Mr. Stoebr

115 (I, II) PRACTICAL CRITICISM

Close reading of a limited number of works as an introduction to literary studies. Special attention to writing.

3 hours, 4 credits

Prerequisite: English 102

Mr. Blair, Mr. Lyons, Mr. Risse

201 (I), 202 (II) INTRODUCTION TO BRITISH LITERATURE

The major periods, genres, and writers of English literature and the relationship be-

tween literature and social and intellectual history. The first semester covers the period from the Middle Ages to the 18th century; the second semester from the 18th to the early 20th century. Primarily intended for students planning to major in English. Critical papers required.

3 hours, 4 credits

Prerequisite: English 102

Mr. Knight, Mrs. Mull

203 (I), 204 (II) INTRODUCTION TO LITERATURE IN AMERICA

First semester: works before 1870 by such writers as Taylor, Edwards, Cooper, Poe, Emerson, Thoreau, Douglass, Hawthorne, Melville, Whitman, and Dickinson. Second semester: works after 1870 by such writers as Twain, James, Hemingway, Faulkner, Ellison, Porter, Frost, Eliot, O'Neill, Miller, and Albee. Special attention to writing.

3 hours, 4 credits

Prerequisite: English 102

Miss Finney, Mr. Grove, Mr. Katz,
Mrs. Warren

211 (I, II) FORMS OF ENGLISH POETRY TO 1700

Individual poems in relation to poems of like kinds. Includes examples of such forms as the ballad, the song, the pastoral, the sonnet, the epic, and narrative verse. Special attention to writing.

3 hours, 4 credits

Prerequisite: English 102

Mr. Broderick, Miss Edwards,
Miss McAlpine, Mr. Smith

212 (I, II) FORMS OF ENGLISH AND AMERICAN POETRY SINCE 1700

Individual poems in relation to poems of like kinds. Explores the adaptation of traditional poetic forms to changing thematic and stylistic concerns. Eight to ten major poets are considered, with emphasis on modern poets (Yeats, Eliot, Frost, Stevens). Special attention to writing.

3 hours, 4 credits

Prerequisite: English 102

Mrs. Alonso, Mr. Helms, Mr. Morahan,
Mr. Nelson, Mrs. Veenendaal, Mr. Willey

215 (I, II) FORMS OF ENGLISH PROSE FICTION

The various kinds of English prose fiction, with some attention to their literary and intellectual milieu. Critical papers required.

3 hours, 4 credits

Prerequisite: English 102

Mr. Frederick, Mr. Gay, Miss Mautner

216 (I, II) FORMS OF AMERICAN PROSE FICTION

The various kinds of American prose fiction, with some attention to their literary and intellectual milieu. Critical papers required.

3 hours, 4 credits

Prerequisite: English 102

Miss Finney, Mr. Frederick, Mr. Grove,
Mr. O'Connell, Mr. Tribble, Mr. Willey

219 (I, II) FORMS OF ENGLISH DRAMA TO 1700

Readings in the English Drama from its beginnings through the Elizabethan Age. Development of such forms as the chronicle play, the miracle play, and comedy and tragedy. Special attention to writing.

3 hours, 4 credits

Prerequisite: English 102

Mr. Babcock, Mr. Slover, Mr. Sweeney

220 (I, II) FORMS OF ENGLISH AND AMERICAN DRAMA SINCE 1700

Consideration of drama in English since 1700, with reference to earlier dramatic forms and European works where appropriate. Special attention to the variety of techniques uniquely available to the dramatist. Critical papers required.

3 hours, 4 credits

Prerequisite: English 102

Mr. Babcock, Mr. Slover

358 (II) BLACK LITERATURE IN AMERICA

The historical and social context from which American Negro writing emerged; works by such authors as Johnson, Hughes, Wright, Ellison, Baldwin, Brooks, Tolson and Jones. Special attention to writing.

3 hours, 4 credits

Prerequisite: English 102

Mr. Sanders, Mr. Senna

RELATED COURSES:

Humanities 114 (I, II) Masterpieces of Western Literature

Humanities 252, 253 (I, II) Film Study I and Film Study II

GROUP II: LITERARY GENRES

304 (II) MEDIEVAL POETRY

English poetry from 700 to 1500.

Prerequisite: 1 soph. Eng. course

Miss Edwards, Mrs. Ferguson,
Miss McAlpine

312 (II) RENAISSANCE POETRY

The poetry of Spenser, Sidney, Shakespeare, Marlowe, and others.

Prerequisite: 1 soph. Eng. course

Mr. Morahan, Mrs. Mull, Mrs. Veenendaal

319 (I) ELIZABETHAN AND STUART DRAMA

The major plays of the period. The relationships between dramatic form and theatre conventions and conditions. Special attention to Marlowe, Jonson, Webster, Middleton, and Ford.

Prerequisite: 1 soph. Eng. course

Mr. Babcock, Mr. Sweeney

322 (I) ENGLISH POETRY OF THE EARLY SEVENTEENTH CENTURY

Divergent traditions in 17th century poetry, with emphasis on the "schools" of Donne and Jonson. Poets include Donne, Herbert, Vaughan, Marvell, Jonson, Herrick, Waller, and Carew.

Prerequisite: 1 soph. Eng. course

Mr. Chernaik, Mr. Divver

325 (II) SEVENTEENTH-CENTURY PROSE

The development of 17th-century prose in light of intellectual and aesthetic preoccupations of the period. Authors include Bacon, Donne, Browne, Hobbes, Milton and Dryden.

Prerequisite: 1 soph. Eng. course

Mr. Divver

337 (II) EIGHTEENTH-CENTURY FICTION

The historical emergence of the novel and aesthetic characteristics of the form in the works of such early masters as Defoe, Richardson and Fielding.

Prerequisite: 1 soph. Eng. course

Mr. Gay, Mr. Knight

342 (II) VICTORIAN POETRY

Selected works by Tennyson, Browning, Arnold, Hopkins, and Hardy.

Prerequisite: 1 soph. Eng. course

Mr. Broderick, Mr. Ryan

347 (II) NINETEENTH-CENTURY ENGLISH PROSE FICTION

Major English novelists of the 19th century, including the Brontës, George Eliot, Dickens, Thackeray, Meredith, and Hardy.

Prerequisite: 1 soph. Eng. course

Mr. Lyons, Mr. Stoehr, Mr. Willey

350 (I) AUTOBIOGRAPHY IN AMERICA

The major autobiographical works, from colonial to modern times, by such writers as Edwards, Franklin, Thoreau, James, Adams, Fitzgerald, Malcolm X, and Mailer.
Prerequisite: 1 soph. Eng. course

Mr. Van Os

351 (II) AMERICAN NON-FICTIONAL PROSE

The relationship between art and thought in selected works by such writers as Edwards, Emerson, Thoreau, Whitman, Twain, William James, DuBois, Adams, Wright, and Hemingway.
Prerequisite: 1 soph. Eng. course

Mr. Gittleman, Mr. Stoehr

352 (II) MODERN AMERICAN POETRY

Major trends and figures in 20th-century American poetry, from the Imagist movement and the founding of *Poetry* in 1912 to the present. Emphasis on Frost, Eliot, Pound, Williams, Stevens, Cummings, Lowell, Roethke, Wilbur, and Dickey.
Prerequisite: 1 soph. Eng. course

Mrs. Alonso, Miss Finney, Mr. Webb, Mr. Willey

357 (II) MODERN AMERICAN FICTION

Major American novelists from about 1890 to the present. The art of Crane, Dreiser, Wharton, Dos Passos, Hemingway, Fitzgerald, Faulkner, and West, including recurrent social and cultural themes in their works.
Prerequisite: 1 soph. Eng. course

Mr. Grove, Mr. O'Connell, Mr. Willey

359 (II) MODERN DRAMA

Development of naturalism, impressionism, and the tradition of the New Theatre in 19th- and 20th-century drama. Continental, English, and American plays.
Prerequisite: 1 soph. Eng. course

Mr. Babcock

360 (I) MID-TWENTIETH CENTURY DRAMA

The ideas, values, and techniques of the contemporary theatre.
Prerequisite: 1 soph. Eng. course

Mr. Babcock

362 (I) POST WORLD WAR II COMIC FICTION

The art and the vision of contemporary life

of such post-war comic novelists as Bellow, Roth, Donleavy, and Nabokov.

Prerequisite: 1 soph. Eng. course

Mrs. Warren

367 (I) CONTEMPORARY WOMEN POETS

Poetry by contemporary women writers, with some attention to earlier writers and to relevant historical, sociological, and psychological materials.

Prerequisite: 1 soph. Eng. course

Mrs. Alonso

372 (II) SATIRE

The problems involved in defining satire from social, philosophical, and formalist points of view. Reading and discussion of a number of satiric works from a variety of genres and periods, from classical times to the present.

Prerequisite: 1 soph. Eng. course

Mr. Blair, Mr. Chernaik

387 (I) NARRATIVE IN THE NOVEL AND FILM

The nature of narrative as revealed through a comparative study of selected novels and films, attention to the artists' use of sequence, imagery, point of view, and other aspects of technique.

Prerequisite: 1 soph. Eng. course

Miss Slotnick

GROUP III: LITERATURE IN ITS CULTURAL CONTEXT

275 (I, II) THE MEDIEVAL PERIOD

The concerns and techniques of Old and Middle English writers including the *Beowulf* and *Gawain* poets, the Wakefield dramatist, Gower, Langland, Chaucer, and Malory.

Prerequisite: 1 soph. Eng. course

Mrs. Collins, Miss Edwards, Miss McAlpine

277 (I, II) THE RENAISSANCE

The predominant currents of thought in the Renaissance as exemplified by the works of such writers as More, Lyly, Marlowe, Jonson, Sidney, Wyatt, Surrey, and Shakespeare. Supplementary readings from Renaissance criticism.

Prerequisite: 1 soph. Eng. course

Mr. Chernaik, Mr. Diver, Mrs. Mull

281 (I, II) THE NEO-CLASSICAL PERIOD

The chief intellectual and social currents of the Restoration and 18th century, and of the

works of such writers as Dryden, Swift, Pope, Defoe, Fielding, Johnson, and Burke.
Prerequisite: 1 soph. Eng. course

Mr. Marks

283 (I, II) THE ROMANTIC PERIOD

The literature and leading ideas of English Romanticism, with special emphasis on the poetry and prose of Blake, Wordsworth, Coleridge, Byron, Keats, and Shelley.

Prerequisite: 1 soph. Eng. course

Mr. Broderick, Mr. Ryan

285 (I, II) THE VICTORIAN AGE

Readings in Carlyle, Tennyson, Dickens, Browning, Newman, Arnold, Hopkins, and Pater, whose work will be studied in the context of the literary, intellectual, and social history of the Victorian Age.

Prerequisite: 1 soph. Eng. course

Mr. Lyons, Mr. Ryan

287 (I, II) AMERICAN ROMANTICISM

The growing importance of symbol and ideal in the period from 1836 to 1855. Emphasis on romantic imagination in Poe, Emerson, Thoreau, Hawthorne, and Melville, with readings in the Cambridge school and the minor Transcendentalists.

Prerequisite: 1 soph. Eng. course

Mr. Gittleman, Mrs. Rosenmeier,
Mr. Sanders, Mr. Stoehr, Mr. Van Os

289 (I, II) THE RISE OF AMERICAN REALISM

The emergence of Realism in the fiction of Twain, James and Howells, and its development into the naturalism of Norris, Crane, Dreiser.

Prerequisite: 1 soph. Eng. course

Mr. Katz

290 (I) A CRITICAL DECADE IN AMERICAN LITERATURE

Major and representative works of an important ten-year period. Emphasis on ways in which styles and themes cohere and on the relationship of history and literature. Decade studied is announced each term during pre-registration.

Prerequisite: 1 soph. Eng. course

Mr. O'Connell

291 (I, II) THE MODERN PERIOD

Readings in such writers as Eliot, Hemingway, Lawrence, Joyce, Faulkner, Auden, Thomas, Lowell, Yeats, Stevens, and Lessing.

Prerequisite: 1 soph. Eng. course

Miss Kremen, Mr. Nelson, Mrs. Warren

294 THE AMERICAN HERO

Through an examination of several representative American novels, an attempt to define the American hero and the values he exemplifies as he works toward self-discovery and tests himself in the world.

Prerequisite: 1 soph. Eng. course

Mrs. Warren

GROUP IV: REGIONAL AND ETHNIC LITERATURE

303 (I) EARLY CELTIC LITERATURE IN TRANSLATION

The mythological, heroic, and lyric literature of Ireland and Wales in its cultural context, from the earliest written sources through the later Middle Ages.

Prerequisite: 1 soph. Eng. course

Mr. Bowen

349 (I) THE BLACK PRESENCE IN AMERICAN LITERATURE

Nineteenth and twentieth-century literary texts by black and white writers who wrote with a significant consciousness of black people in American society.

Prerequisite: 1 soph. Eng. course

Mr. Gittleman, Mr. Murray, Mr. Sanders

361 (I) IRISH LITERATURE

Leading figures of the Irish Renaissance, with special emphasis on Joyce, Yeats, Synge, and O'Casey.

Prerequisite: 1 soph. Eng. course

Mrs. Curran

HUMANITIES 249 (I, II) AFRICAN LITERATURE

Includes such writers as Yacine, Bourboune, Ouologuem, Soyinka, Ngugi, p'Bitek, Paton, and Abrahams.

Prerequisite: 1 soph. Eng. course

Mr. Senna

GROUP V: MAJOR AUTHORS

305 (I) CHAUCER

The Canterbury Tales and selected minor works.

Prerequisite: 1 soph. Eng. course

Miss Edwards, Miss McAlpine, Mrs. Mull

313 (I) SHAKESPEARE'S PLAYS: A SURVEY

The comedies, early histories, and early tragedies of Shakespeare.

Prerequisite: 1 soph. Eng. course

Mr. Bluestone, Mr. Chernaik, Mr. Slover

**314 (II) SHAKESPEARE'S PLAYS:
A SURVEY**

Continuation of English 313: the later histories, problem plays, major tragedies, and late romances.

Prerequisite: 1 soph. Eng. course

Mr. Bluestone, Mr. Chernaik, Mr. Slover

326 (II) MILTON

The major poetry and prose of John Milton.

Prerequisite: 1 soph. Eng. course Staff

339 (I) BLAKE

Readings in lyrics and prophecies of William Blake.

Prerequisite: 1 soph. Eng. course

Miss Kremen, Mr. Schreiber

363 (II) YEATS

Yeats' development as a poet, from his early Pre-Raphaelite poetry through his late-modern poems, within the framework of Irish history and literature.

Prerequisite: 1 soph. Eng. course

Mrs. Curran

365 (I) FAULKNER

Faulkner's fiction studied as a major saga of modern man.

Prerequisite: 1 soph. Eng. course

Mr. Marvin, Mr. O'Connell, Mr. Tribble

**366 (I) FITZGERALD AND
HEMINGWAY**

Representative texts by Fitzgerald and Hemingway; their aesthetic achievement and their biographical and historical settings.

Prerequisite: 1 soph. Eng. course

Mr. Frederick

**GROUP VI: LANGUAGE,
LITERARY CRITICISM, AND
OTHER TOPICS**

**293 (I) THE ADOLESCENT IN
LITERATURE**

Such problems as adolescent culture, the rites of passage into adulthood, and the literary expression of these phenomena. Writers such as Wolfe, Salinger, Capote, Knowles, McCullers, Donleavy, Mishima, Golding, Lessing, Moravia, Mauriac, Sagan included.

Prerequisite: 1 soph. Eng. course

Mr. Grove

**374 (II) PRINCIPLES AND METHODS
OF LITERARY CRITICISM**

The leading principles and methods of

Western literary criticism considered in their historical contexts and in reference to modern literary thought.

Prerequisite: 1 soph. Eng. course

Mrs. Marks

**375 (I) HISTORY OF THE ENGLISH
LANGUAGE**

Development of the English language from its beginnings to the present; selected passages of British and American writing and speech; concepts and techniques of descriptive linguistics.

Prerequisite: 1 soph. Eng. course or permission of instructor

Mrs. Collins, Miss Edwards, Mrs. Ferguson

376 (II) HISTORY OF PROSE STYLE

Characteristics of literary and oral English prose styles from Middle English to the present.

Prerequisite: 1 soph. Eng. course Staff

**377 (II) OLD ENGLISH LANGUAGE
AND LITERATURE**

The language and literature of England, 449 to 1150. The course will give students a reading knowledge of the language and an introduction to major literary forms.

Prerequisite: 1 soph. Eng. course

Mrs. Ferguson

**381 (I), 382 (II) SELECTED TOPICS
IN ENGLISH AND AMERICAN
LITERATURE**

Intensive study of topics in literature. Course content will vary each semester and will be announced during pre-registration periods.

Prerequisite: 1 soph. Eng. course Staff

RELATED COURSES:

Humanities 243 (I) Mythology and Literature

Humanities 260 (I) Visionary and Prophetic Modes in Literature

Humanities 383 (II) The Image of Women in Literature

GROUP VII: WRITING

250 (I), 251 (II) CREATIVE WRITING

Techniques and forms of fiction and poetry. Classroom discussion of student manuscripts and frequent conferences.

Prerequisite: Permission of instructor

Mr. Bidart, Mr. Marvin, Mr. Richer,

Mrs. Veenendaal

252 (I) ADVANCED COMPOSITION
Techniques of effective expository writing.
Prerequisite: 1 soph. Eng. course
Mr. Babcock, Mrs. Berthoff, Mr. Nelson

253 (I), 254 (II) CREATIVE WRITING WORKSHOP

The structuring of chapters of a short novel, the thematic relationships in a series of stories or poems, and development of style and point of view.

Prerequisite: Senior standing and permission of instructor
Mrs. Curran, Mr. Marvin

GROUP VIII: SPECIALLY DIRECTED STUDY

ENGLISH COURSE FOR TEACHER CERTIFICATION:

386 METHODS AND PRACTICE TEACHING OF ENGLISH IN SECONDARY SCHOOLS

The issues and principles of the learning and teaching of secondary school composition, literature, and language. Supervision and critique of practice teaching in the schools. 3 hours, 20 hours laboratory (practice teaching), 9 credits (6 toward major).

Prerequisite: 6 hours Education courses

Mr. Campbell

390 (I), 391 (II) SENIOR SEMINARS

In-depth study of special topics in British and American literature. Course content will vary each semester and will be announced during pre-registration periods. Classes limited to 15 students.

Prerequisite: Senior standing and permission of instructor
Staff

397 (I, II) INDEPENDENT STUDY

Open only to a very limited number of students in any one semester. A written prospectus of the project is required of applicants.

Prerequisite: Permission of instructor and department chairman
Staff

398 (I) HONORS WORK I

An intensive program of study planned with an honors adviser who will provide counsel and direction as needed and desired. Either a special project or wide reading in English and American literature designed to acquaint the student with areas not adequately covered by his courses or by independent work. Requires a final oral examination administered by members of the Honors Board, presided over by the adviser.

Prerequisite: Senior standing, 3.0 overall and major average, and permission of Honors Committee
Staff

399 (II) HONORS WORK II

In-depth study of a topic chosen by the student, and a paper written with the approval and under the direction of an honors adviser, normally arising from reading done in Honors Work I. Departmental Honors will be awarded on the basis of the Honors Work I oral examination and the evaluation of the paper by the Honors Board.

Prerequisite: English 398 and permission of Honors Committee
Staff

FRENCH

COLLEGE I

ALFRED C. PROULX, PH.D., Associate Professor of French and Chairman of French, College I; JOHN MACCOMBIE, PH.D., Associate Professor of French; MARY LEE EVANS KIMBALL, D.E.U., Assistant Professor of French; GERALD C. VOLPE, PH.D., Assistant Professor of French and Italian; VIRGINIA MERLIER, M.A., MARYLYN SORENSON, M.A., CHRISTIAN TACONET, M.A., Instructors in French; DAVID BUSKEY, M.A., Lecturer in French.

COLLEGE II

JEAN COLLIGNON, Agrégé d'anglais, Professor of French and Chairman of French, College, II; MICHEL PHILIP, Agrégé des lettres, Associate Professor of French; ROSE ABENDSTERN, PH.D., JEANNE GRILLET, Docteur En Linguistique, BRIAN THOMPSON, PH.D., Assistant Professors of French; DAVID BRUBAKER, M.A., MONIQUE STERN, M.A., LILIAN WILLENS, M.A., Instructors in French.

GRADUATION REQUIREMENTS

French majors must take a minimum of 30 credits. Of these, 6 credits are required, French 241-242, and a minimum of 24 credits at the Junior-Senior level (French 300 and above). The distribution of required credits must include 3 credits in each of the following areas: 17th century, 18th, 19th, 20th, and either 16th or Middle Ages. Students are urged to elect French 241-242 in the sopho-

more year. (Note: French 231-232 cannot be used for major credit.)

Students participating in the departmental TCP program may count six credits earned in the program toward fulfilling major requirements.

It is strongly recommended that majors elect two years of course work in a second foreign language.

Honors Thesis: a student may receive 6 credits toward his total 30 major credits for acceptable work on an Honors Thesis written in French under the direction of an adviser from the French faculty.

At the end of the Senior year, majors may take a comprehensive exam in French, covering three specific fields of French literature (the fields to be chosen by the student), to be eligible for one of the French Department prizes.

It is recommended that students take the Educational Testing Service (ETS) language proficiency exams in the spring of their Senior year.

COURSE OFFERINGS

(3 hours, 3 credits each, unless specified)
Courses number 161, 162, 163, 164, 165, 260, 261, 262 and 263 are literature courses in translation. They satisfy the language requirement. All other courses are given in French.

111 (I), 112 (II) ELEMENTARY FRENCH

Intensive practice in the four language skills, with an audio-lingual approach, for students who have no creditable training in French.
4 hours, 2 hours laboratory
4 credits each semester

Miss Grillet and Staff

115 (I) BASIC ORAL FRENCH

Extensive oral practice and drill of basic linguistic patterns in French for students who need them to qualify for Intermediate French.
4 hours, 2 hours laboratory, 4 credits
Prerequisite: Background in the language and placement exam

Mr. Thompson and Staff

121 (I, II), 122 (I, II) INTERMEDIATE FRENCH

Intensive review and further study of gram-

mar and audio-lingual skills with correlated intermediate-level readings in French literature.

4 hours, 2 hours laboratory, 4 credits each semester

Prerequisite: French 112 or equivalent

Miss Sorenson and Staff

125 (I), 126 (II) INTENSIVE FRENCH

Intensive work in the four language skills with concentration on an audio-lingual approach and an introduction to literature, for students with no creditable previous training in French who intend to continue their study of French language and literature at an advanced level. Students completing this course satisfactorily will be allowed to enter directly into courses at the 200 level and above.

9 hours, 3 laboratory periods, 8 credits each semester

Prerequisite: Minimum score of 600 on the SAT verbal or high upper-class course average; departmental permission

Miss Sorenson and Staff

161 (I) TWENTIETH CENTURY FRENCH NOVEL

Major French writers of the 20th century: Gide, Cocteau, Fournier, Mauriac, Malraux, Camus, Robbe-Grillet. Readings in English; no knowledge of French required. Staff
4 credits

162 (II) CONTEMPORARY FRENCH THEATRE

Some of the masterpieces of French theatre from Giraudoux to the theatre of the absurd. Readings in English; no knowledge of French required. Staff
4 credits

163 (I) POLITICAL TRENDS IN THE CREATIVE ARTS IN TWENTIETH CENTURY FRANCE

The political trends in modern France as they appear in such art forms as the novel, the theatre, poetry, the film, painting, political and artistic memoirs, the dance. Readings in English; no knowledge of French required. Mr. Brubaker
4 credits

164 (II) FRENCH EXISTENTIAL LITERATURE

Major works by Camus, Sartre, Beauvoir, Celine, Malraux. Readings in English; no knowledge of French required. Mr. Proulx
4 credits

165 (I) MASTERPIECES OF FRENCH LITERATURE

Selected major texts from the Middle Ages to the end of the nineteenth century. Readings in English; no knowledge of French required.

Staff

4 credits

231 (I, II) SURVEY OF FRENCH LITERATURE

French literature and culture from the 11th century through the mid-18th century.

Prerequisite: French 122 or equivalent
Miss Abendstern and Staff

232 (I, II) SURVEY OF FRENCH LITERATURE

French literature and culture from the mid-18th century through the mid-20th century.

Prerequisite: French 122 or equivalent
Miss Abendstern and Staff

234 (II) THE GREAT POETS OF THE MODERN FRENCH SONG

The tradition of the *chanson* in France, from the medieval troubadours to modern times, with contemporary singer-composers: Brassens, Brel, Barbara, and others.

Prerequisite: French 121-122 or permission of instructor
Mr. Thompson

235 (I, II) FRENCH WRITERS AS WITNESSES OF THEIR TIMES

Treatment of one main theme (such as the education of women and their role in society; the attitude of youth towards society and of society towards youth; moral sincerity; the discovery of self) developed through study of works from different periods of French literature. The theme will vary each semester and will be announced in advance.

Prerequisite: French 122 or equivalent
Mr. Philip

238 POLITICS IN FRENCH LITERATURE

Analysis of political aspects of major French literary texts from Rabelais to Charles de Gaulle.

Prerequisite: French 122 or equivalent
Staff

240 (II) ADVANCED FRENCH CONVERSATION

Daily practice in conversation on a wide variety of subjects, with a view to building vocabulary and fluency. A multi-instructor course, to insure a wider range of linguistic experience. Especially recommended for

French majors who do not plan to take the year in France.

Prerequisite: French 122 or equivalent and permission of instructor
Staff

241 (I, II) TRANSLATION AND STYLISTICS

Intensive study of grammar, stylistics and composition; problems of idiomatic translation based on contemporary English and American texts.

3 hours, 2 hours laboratory, 3 credits
Prerequisite: French 122 or equivalent, or permission of instructor
Staff

242 (I, II) TEXTUAL ANALYSIS

Intensive study of methods of literary analysis, based on texts selected from various periods of French literature.

3 hours, 2 hours laboratory, 3 credits
Prerequisite: French 241 or equivalent, or permission of instructor
Staff

260 THE NINETEENTH CENTURY FRENCH NOVEL IN TRANSLATION

Readings and discussion of major novels of the period from Madame de Staël, Stendhal, Hugo, Balzac, to Flaubert, Zola, Bourget and Huysmans.

Prerequisite: 1 soph. Eng. course or permission of instructor
Staff
4 credits

261 (I) MODERN FRENCH NOVEL IN TRANSLATION: 1900-1935

Works by Proust, Cocteau, Gide, Saint-Exupéry and Malraux.

Prerequisite: 1 soph. Eng. course or permission of instructor
Mr. Proulx
4 credits

262 (II) MODERN FRENCH NOVEL IN TRANSLATION: 1935 UNTIL THE PRESENT

Works by Sartre, Camus, Mauriac, Robbe-Grillet, and Genet.

Prerequisite: 1 soph. Eng. course or permission of instructor
Mr. Proulx
4 credits

263 (I) THE BLACK SOUL AND THE THEATRE

A comparative approach to the image of the Black man in contemporary theatre. An analytical and comparative study of various French and American plays by white and black French-speaking writers and also of American plays by white and black American writers, all of them dealing with the experience of the Black man.

Prerequisite: 1 soph. Eng. course and reading knowledge of French (some of the French plays not being available in English translation) Staff
4 credits

300 (I) HISTORY OF THE FRENCH LANGUAGE

Survey of the evolution of French from spoken Latin to the modern language with analysis of texts from each major period. Prerequisite: French 232 or 241 or equivalent, or permission of instructor Miss Grillet

301 (II) FRENCH LITERATURE IN THE MIDDLE AGES

Survey of French literature from the 11th century to the 15th, according to genres. All texts (including the *Chanson de Roland*, *Lancelot*, *Tristan et Iseut*, *Roman de Renard*, and lyric poetry) adapted into modern French. Prerequisite: French 232 or 242, or permission of instructor Miss Merlier

302 ADVANCED TRANSLATION

Translation from English into French, from French into English: analysis of the grammatical and stylistic problems of the texts involved. 2 hours, 3 credits
Prerequisites: French 241-242 and course in French Literature Staff

311 (I) THE AGE OF RABELAIS

Chronological survey of French literature in the 16th century, with emphasis on continuity with the Middle Ages, consciousness of the New Age, and Italian influence. Readings from Marot, Rabelais, Calvin, Scève, Labé, Marguerite, d'Angoulême, du Bellay, Ronsard until 1560. Prerequisite: French 232 or 242, or permission of instructor Staff

312 (II) THE AGE OF MONTAIGNE

Readings from Ronsard after 1560, Larivey, Garnier, Montaigne, Sponde, d'Aubigné. Prerequisite: French 232 or 242, or permission of instructor Staff

321 (II) SEVENTEENTH CENTURY FRENCH LITERATURE: THEATRE AND PHILOSOPHERS

Works from 17th century authors including Descartes, Corneille, Racine, Molière, and Pascal. Prerequisite: French 232 or 242, or permission of instructor Staff

322 (II) SEVENTEENTH CENTURY FRENCH LITERATURE: PROSE WRITERS AND PHILOSOPHERS

Works by Bossuet, Boileau, La Fontaine, Madame de La Fayette, La Rochefoucauld, Madame de Sevigné, La Bruyère. Prerequisite: French 232 or 242, or permission of instructor Staff

331 (I) EIGHTEENTH CENTURY THEATRE AND NOVELS

Plays by Marivaux and Beaumarchais, and novels by Voltaire, Diderot, J. J. Rousseau, Laclos. Prerequisite: French 232 or 242, or permission of instructor Staff

332 (II) EIGHTEENTH CENTURY PHILOSOPHERS

Philosophical texts by Montesquieu, Diderot, Voltaire, Rousseau, Condillac; *l'Encyclopédie*. Prerequisite: French 232 or 242, or permission of instructor Mr. Collignon

341 (I) FRENCH ROMANTICISM: PREROMANTICISM AND POETS

Chateaubriand and Romantic poets including Lamartine, Hugo, Vigny, Musset, Nerval. Prerequisite: French 232 or 242, or permission of instructor Miss Abendstern

342 (II) FRENCH ROMANTICISM: THEATRE AND NOVELS

The French Romantic theatre and novel through works by Hugo, Vigny, Musset, Sand, Balzac, Stendhal. Prerequisite: French 232 or 242, or permission of instructor Miss Abendstern

345 (I) SYMBOLIST POETRY

Works selected from the poetry of Baudelaire, Verlaine, Rimbaud, and Mallarmé. Prerequisite: French 232 or 242, or permission of instructor Mr. Philip

346 (II) CONTEMPORARY POETRY

Works by Claudel, Apollinaire, Aragon, René Char, Francis Ponge, Valéry, St. Jean de Perse. Prerequisite: French 232 or 242, or permission of instructor Mr. MacCombie

348 (I) THE NOVEL FROM 1850-1900

Novels by Flaubert, Fromentin, les Goncourt, Maupassant, Zola, Huysmans. Prerequisite: French 232 or 242, or permission of instructor Staff

**353 (I) TWENTIETH CENTURY
NOVEL FROM 1900 TO 1935**

Works by Proust, Fournier, Radiguet, Cocteau, Colette, Gide, Mauriac, Green and Saint-Exupéry.

Prerequisite: French 232 or 242, or permission of instructor Staff

**354 (II) TWENTIETH CENTURY
NOVEL FROM 1935 TO THE PRESENT**

Works by Celine, Sartre, Camus, S. de Beauvoir, Robbe-Grillet, Genet and Pinget.

Prerequisite: French 232 or 242, or permission of instructor Staff

**355 (I) TWENTIETH CENTURY
THEATRE TO 1939**

Representative plays by Feydeau, Jarry, Claudel, Giraudoux and Montherlant.

Prerequisite: French 232 or 242, or permission of instructor Mr. Collignon

**356 (II) TWENTIETH CENTURY
THEATRE FROM 1939 TO THE
PRESENT**

Representative plays by Sartre, Camus, Ionesco, Genet, and Beckett.

Prerequisite: French 232 or 242, or permission of instructor Staff

**358 (II) BLACK FRENCH
LITERATURE**

Selected prose and poetry of representative Black authors in French-speaking countries, focusing on the works of Senghor, Césaire, Damas, and Camara-Laye.

Prerequisite: French 231 or 241, or permission of instructor Staff

**362 (II) THE THEME OF EDUCATION
IN FRENCH LITERATURE**

French texts relative to pedagogic and educational theory: LaSalle, Montaigne, Rabelais, Molière, and Rousseau.

Prerequisite: French 232 or 242, or permission of instructor Mr. Volpe

365 (I) FRENCH CIVILIZATION

The background of contemporary France; today's France; historical, political, social, economic, cultural.

Prerequisite: French 231 or 241 or equivalent Mr. Brubaker

**366 (II) FRENCH HISTORIANS AND
THEIR WRITINGS ON FRANCE
SINCE 1650**

The major French historians and their work both as objective observers and as creative writers. Mr. Brubaker

**371 (I) SEMINAR: THE "FANTASTIC"
AND SUPERNATURAL IN
NINETEENTH CENTURY LITERATURE**

Works by Nodier, Balzac, Lautréamont, Barbey d'Aurevilly, Villiers de l'Isle-Adam.

Prerequisite: permission of instructor Staff

**372 (II) SEMINAR: TWENTIETH
CENTURY AVANT-GARDE WRITERS**

Works by Proust, Roussel, Breton, Artaud, Beckett, Ponge, Blanchot.

Prerequisite: Permission of instructor Staff

373 (I) SEMINAR: EXISTENTIALISM

Works by Gide, Malraux, Camus, Sartre, de Beauvoir, Beckett, and Celine as they reveal existentialism concepts and their development.

Prerequisite: French 231 or 241, or permission of instructor Mr. Proulx

**374 (II) SEMINAR: CATHOLIC
LITERATURE FROM 1800 TO 1930**

The novel, theater, and poetry of Bourget, Barrès, Péguy, Claudel, Martin du Gard, Bernanos, and Mauriac with emphasis on the manner in which Catholic religious beliefs, generally considered essential to the literary formation of these authors, are reflected and differentiated in the development of their works.

Prerequisite: French 232 or 242, or permission of instructor Staff

**376 (II) SEMINAR: THE FORM OF
THE NOVEL FROM THE
SEVENTEENTH CENTURY TO THE
PRESENT**

The novel as a genre, starting with one of the first masterworks, *La Princesse de Cleves*; how it evolved to its present form.

Prerequisite: Permission of instructor Mr. Philip

**377 (I) SEMINAR: THE PROPHETS
OF THE APOCALYPSE**

(Revolts, visionnaires et décadents)

Poets and prose writers somewhat removed from the main literary currents of the late 19th century by their originality or even eccentricity. Writers such as Rimbaud, Lautréamont, Laforgue, Villiers de l'Isle Adam and others who revolted against their times and their society.

Prerequisite: French 231 or 241, or permission of instructor Staff

379 (I) SEMINAR: THE ART OF WRITING, THEORY AND PRACTICE

A creative writing seminar in French: poems, plays, short stories, essays. Professional criticism and discussion.

Prerequisite: Permission of instructor Staff

380 (II) SEMINAR ON A MAJOR FRENCH AUTHOR

In-depth analysis of an author or of the major works of an author to be specified each year.

Prerequisite: Permission of instructor Staff

383 (I) FRENCH SEMINAR: FACT AND FICTION IN THE FRENCH REALIST NOVEL

The novels of Balzac, Zola and Malraux; various theoretical and critical formulations on the novel as a genre, leading toward understanding of the writers as creative artists.

Prerequisite: Successful completion of one course on the novel at the 300 level.

Mr. Thompson

386 (I, II) METHOD AND PRACTICE TEACHING OF FRENCH IN SECONDARY SCHOOLS

The issues, principles and methods of secondary school French language teaching. Supervision and critique of practice teaching.

3 hours, 20 hours laboratory (practice teaching), 9 credits

Prerequisite: 6 hours Education courses Miss Willens

398 (I), 399 (II) HONORS THESIS IN FRENCH

Independent and original investigation and study under the supervision of a faculty adviser. An oral defense of the thesis before members of the French department is required.

3 credits each semester

Prerequisite: Departmental permission Staff

GERMAN COLLEGE I

LYNN DHORITY, PH.D., Associate Professor of German and Chairman of German, College I; ALFRED HOELZEL, PH.D., Associate Professor of German; LUISE BRONNER, PH.D., RITTA JO HORSLEY,

PH.D., FRIEDRICH P. OTT, PH.D., Assistant Professors of German.

COLLEGE II

ROBERT SPAETHLING, PH.D., Professor of German and Chairman of German, College II; ANDREW BOELCSKEVY, PH.D., DAVID MILES, PH.D., SANDRA SHUMAN, PH.D., Assistant Professors of German.

GRADUATION REQUIREMENTS

German majors must take a minimum of 27 credits in Junior-Senior level department courses including German 231 or German 232, German 221-222, and German 331-332. A maximum of two courses offered by the German Department in English translation may be counted toward fulfilling the major requirement. History 237-238 (German History) offered by the History Department is required in addition to the 27 credits. Students participating in the departmental TCP program may count six credits earned in the program toward fulfilling major requirements. Second semester Seniors will take the ETS Undergraduate Record Examination in German.

Departmental Honors. For graduation with honors in German, students must have 3.0 overall cumulative average at the end of the senior year. They must have participated in the Honors Seminar to be offered in the Spring semester. (The department will confer at the end of the fall semester to nominate potential honors candidates among the German major Seniors and invite them to participate in the Honors Seminar.) They must acquire themselves with honors in the Seminar, and be recommended for honors in the departmental evaluation of all graduating German majors which takes place in the Spring.

Note: The German Department strongly encourages all majors in German to achieve a solid background in a second field, preferably in an area within the Humanities, or in European History, or in Politics. The extent to which this is possible will be directly related to the amount of creditable prior training in

German which a student offers upon entrance to the Department.

COURSE OFFERINGS

(3 hours, 3 credits each, unless specified)
Courses numbered 150-1, 151-1, 151-2, 152, 241, 242, 251, 255, 256, 257, 258 and 332 are literature courses in translation. They satisfy the language requirement. All other courses are given in German.

111 (I), 112 (II) ELEMENTARY GERMAN

For students with no creditable training in German. Work in the four language skills with particular emphasis on listening and reading comprehension.

4 hours, 2 hours laboratory, 4 credits each semester Staff

115 (I) INTENSIVE GERMAN

A multi-media approach, with concentration on listening and reading comprehension. Open to students with no previous creditable knowledge in German. Good aptitude for learning foreign language is essential. Upon completion, students may enter German 121 and, in special instances, 122.

8 hours, 3 hours laboratory, 8 credits

Prerequisite: Permission of instructor

Mrs. Horsley, Mr. Ott

121 (I) INTERMEDIATE GERMAN I

Intensive grammar review and selected readings in a variety of fields.

4 hours, 4 credits

Prerequisite: German 111 or equivalent

Staff

122 (II) INTERMEDIATE GERMAN II

Intensive reading and vocabulary building. Reading in the fields of Humanities, Natural and Social Sciences.

4 hours, 4 credits

Prerequisite: German 112 or equivalent

Staff

125 (II) ACCELERATED INTERMEDIATE GERMAN

Development of reading ability and vocabulary while continuing the oral and writing skills developed in German 115 or elsewhere. Opportunity is given to fulfill the second-year language requirement by exam on completion of the course.

4 hours, 4 credits

Prerequisite: Permission of instructor Staff

150-1 (I) GOETHE AND HIS AGE

Representative works of German "Storm and Stress," Classicism and early Romanticism. Includes Goethe, Schiller, Holderlin, Novalis, Kleist. Conducted in English.

3 hours, 4 credits

Mr. Dhority

151-1 (II) THE CRISIS OF MORAL RELATIVISM IN MODERN GERMAN LITERATURE

Three attempted solutions will be explored: the esthetic (T. Mann, S. George); the metaphysical (Hesse, Rilke, Kafka); the social (Kaiser, Toller, Brecht). Conducted in English.

3 hours, 4 credits

Mr. Boelcskev

151-2 (II) NIETZSCHE AND THE GERMAN ARTS

Nietzsche's romantic heritage and his legacy to the twentieth century as revealed in his works and the works of other artists from 1870-1950. Conducted in English.

3 hours, 4 credits

Mr. Dhority

152 (II) EAST VERSUS WEST IN CONTEMPORARY GERMAN LITERATURE

The emergence of the two Germanys as reflected in the works of Grass, Weiss, Uwe Johnson, Brecht and other representative writers. Conducted in English.

3 hours, 4 credits

Mr. Boelcskev

221 (I), 222 (II) COMPOSITION AND CONVERSATION

Grammar; vocabulary building, idioms. Oral and written essays.

Prerequisite: German 122 or equivalent

Mr. Ott

231 (I), 232 (II) INTRODUCTION TO GERMAN LITERATURE

Representative masterpieces of German prose, drama and poetry discussed in cultural and historical context.

Prerequisite: German 122 or equivalent

Mr. Dhority

241 (I) GERMAN CIVILIZATION I

Readings in German history, politics, philosophy, science, literature, and art. From the Reformation to Goethe's death (1832). Conducted in English.

3 hours, 4 credits

Mr. Spaethling

242 (II) GERMAN CIVILIZATION II

From 1830 to the present. Conducted in English.

3 hours, 4 credits

Staff

251 (I) ASPECTS OF MODERN GERMAN LITERATURE

Selected masterpieces of modern German literature including Mann, Hesse, Kafka, and Brecht. Conducted in English.

3 hours, 4 credits Mr. Spaethling

255 (II) HESSE, MANN AND THE ROMANTIC IMAGINATION

Major works of Hesse and Mann in the context of both historical and contemporary Romanticism. Conducted in English.

3 hours, 4 credits Mr. Dhority

256 (II) FAUST: ORIGIN, LEGEND AND THE LITERARY TRADITION

The Faustian tradition: the historical person, the legend and its cultural implications and a four-century literary tradition. Works will include the Fausts of Marlowe, Goethe and Mann. Conducted in English.

3 hours, 4 credits Mr. Spaethling

257 (II) BRECHT AND THE MODERN THEATER

Brecht's emergence as a significant force in the modern theater. An examination of his major plays and theory of the "epic theater" with selected readings of contemporary European and American dramatists. Conducted in English.

3 hours, 4 credits Mr. Boelskevy

258 (I) GERMANY IN THE 20TH CENTURY: WEIMAR AND NAZI CULTURE

A survey of the cultural and creative trends of the Weimar and Nazi periods, with an examination of their roots in Romanticism, Nietzsche, and the Youth Movement. Focus on such exponents as Thomas and Heinrich Mann, the Expressionists, *Weltbühne*, the Bauhaus Group, and Rosenberg's Nazi culture. Conducted in English.

3 hours, 4 credits Mr. Ott

321 (I), 322 (II) ADVANCED CONVERSATION AND COMPOSITION

Based on German 221, 222, but going beyond the prerequisites of grammatical mastery and advanced working knowledge of vocabulary and idioms. Intended to help develop a sensitivity to the right word or expression. An adjunct to the literature courses, developing consciousness and appreciation of literary style in prose and poetry.

Prerequisite: German 222 Mr. Spaethling

331 (I) NATURALISM, NEO-ROMANTICISM AND EXPRESSIONISM

German literature of the Left, the Right, and the Pacifist movement from 1888 to 1918. Readings from such representative writers as Hauptmann, George, Rilke, Hofmannsthal, Wedekind, and the early Brecht.

Prerequisite: German 231 Mr. Miles

332 (II) GERMAN LITERATURE AFTER WORLD WAR I

Major works by such authors as Mann, Kafka, Brecht, Hesse, Frisch, Dürrenmatt, Grass; their relation to 20th Century intellectual life of Germany and the West. Conducted in English.

Miss Shuman

334 (II) GERMAN POST-WAR PROSE FROM EAST AND WEST

Works by Böll, Grass, Johnson, Bienek, Lind and Wolf.

Prerequisite: German 231 Mr. Ott

335 (I) GOETHE AND PRE-ROMANTICISM

Major works of Goethe and Schiller with background readings in the German Enlightenment, Storm and Stress, and German Classicism.

Prerequisite: German 231 Mrs. Horsley

336 (II) GERMAN ROMANTICISM

The major phases of the German Romantic movement.

Prerequisite: German 231 Miss Bronner

341 (I) GERMAN DRAMA FROM LESSING TO THE PRESENT

Selected major German dramas from the 18th Century to the present.

Prerequisite: German 231 Mr. Boelskevy

342 (II) THE GERMAN NOVELLE

The development of the German *Novelle* from the 19th Century to the present.

Prerequisite: German 231 Staff

362 (I, II) HISTORY OF THE GERMAN LANGUAGE

The development of the German language. Staff

364 (II) READINGS IN MIDDLE HIGH GERMAN PROSE AND POETRY

An introduction to the language and literature of medieval Germany.

Prerequisite: German 231 Staff

386 (II) METHODS AND PRACTICE TEACHING OF GERMAN IN SECONDARY SCHOOLS

The issues and principles of the learning and teaching of secondary school German language and culture. Supervision and critique of practice teaching in the schools. 3 hours, 20 hours laboratory (practice teaching), 9 credits

Prerequisite: 6 hours Education courses and permission of instructor Mr. Hoelzel

396 (II) SENIOR HONORS SEMINAR IN GERMAN

A critical investigation of literary themes or genres or of one major literary figure. The writing and defense of a research paper required. Required of all Seniors wishing to graduate with honors in German.

Seminar, 3 credits

Prerequisite: Senior standing; invitation of department Mr. Spaethling

398 (I, II) INDEPENDENT STUDY

Selected research topics organized in consultation with individual student.

3 credits, weekly conferences

Prerequisite: Permission of instructor and chairman of Department Staff

RELATED COURSES:

Humanities 244 (II) Germanic Mythology

Humanities 250 (II) The Hero in Modern European Fiction

Humanities 254 (II) Romanticism in its European Context

HISTORY

COLLEGE I

CARTER JEFFERSON, PH.D., Professor of History and Chairman of History, College I; THOMAS N. BROWN, PH.D., WALTER GROSSMANN, PH.D., ERIC ROBINSON, M.A., Professors of History; FERAZ AHMAD, PH.D., RENÉE N. WATKINS, PH.D., Associate Professors of History; SPENCER DISCALA, PH.D., MICHAEL FELDBERG, PH.D., LINDA GORDON, PH.D., DAVID HUNT, PH.D., ESTHER KINGSTON-MANN, PH.D., PAULINE MAIER, PH.D., WILLIAM A. MOFFETT, PH.D., SUSAN SCHNEIDER, PH.D., Assistant Professors of History; HERBERT P. BIX, M.A., PAUL FALER, M.A., SANFORD GUTMAN, M.A., STANLEY R. REMSBERG, M.A., Instruc-

tors in History; HATIMALI AMIJI, M.A., Lecturer in History.

COLLEGE II

RICHARD H. POWERS, PH.D., Professor of History and Chairman of History, College II; PAUL F. BOLLER, JR., PH.D., PAUL A. GAGNON, PH.D., LOUIS RUCH-AMES, PH.D., Professors of History; WILLIAM A. PERCY, PH.D., ROGER W. PROUTY, PH.D., Associate Professors of History; VAN CLEAF BACHMAN, PH.D., FRANCES HOFFMAN, PH.D., MICHAEL MCCAHILL, PH.D., MARK PINSON, PH.D., MARSHALL SHATZ, PH.D., LESTER A. SEGAL, PH.D., SHELDON STERN, PH.D., Assistant Professors of History; PAUL BOOKBINDER, M.A., TIMOTHY MCCARTHY, M.A., MARTHA TOLPIN, M.A., Instructors in History; CLIVE F. FOSS, M.A., Lecturer in History.

GRADUATION REQUIREMENTS

Majors must take as basic, required courses: two semesters of introductory courses (100-level courses) in the freshman year; History 265 and 266 (Survey of American History) in the sophomore year; and History 403, 404 (Research and Methods Seminar) in the Junior year. Students are also required to include three hours of course work in ancient history, medieval history, or in the history of early modern period before 1700; six hours in European history since 1700; and twelve hours from other courses offered in the Department. Students may take an additional seminar (History 403, 404) and use the course to fill three of the twelve hours of course work required.

HONORS PROGRAM

The requirements for receiving a diploma with Honors in History are: 1. satisfactory completion of all University and Departmental requirements for graduation; 2. an overall 3.0 cumulative average in all Departmental work through the Senior year; 3. satisfactory completion of the Seniors honors paper. Stu-

dents who intend to graduate in June of their Senior year may apply between mid-May of their Junior year and mid-September of their Senior year; those intending to graduate in January should apply between mid-December and mid-January of the preceding academic year.

Candidates whose eligibility is approved by the Department shall be informed that they may try for honors by writing an honors paper. The Honors Committee shall name an individual reading committee made up of three readers to judge the paper. Approval of the paper by at least two of the three readers is necessary for acceptance. A student accepted into the Honors Program must enroll in a 3-credit reading course, History 401—Independent Reading, under the direction of an adviser.

PREREQUISITES

Admission to History 265 and 266 requires Sophomore standing or departmental approval. Admission to all other 200-level and all 300-level and 400-level courses requires Junior standing or departmental approval, unless otherwise specified under the description of the course.

WRITTEN EXPRESSION

All courses in the History Department provide training in written expression.

COURSE OFFERINGS

(3 hours, 3 credits each, unless specified)

INTRODUCTORY HISTORY

105 ELEMENTARY HISTORICAL WRITING

Principles of historical writing: rules of evidence, use of sources, techniques of research, rhetoric, grammar, and style. Several papers required. Freshmen only.
3 hours, 4 credits Staff

CIVILIZATIONS

109 (I) WORLD CIVILIZATIONS I

Pre-industrial civilizations: selected civilizations such as China, India, Greece, Rome, the Christian West; their economies, philo-

sophical and religious beliefs and their social and political structures.

Training in oral and written expression.

3 hours, 4 credits

Mrs. Kingston-Mann, Mr. Prouty

110 (II) WORLD CIVILIZATIONS II

Industrial civilizations: the industrial and social revolutions in the West and their impact on other civilizations.

Training in oral and written expression.

3 hours, 4 credits

Mrs. Kingston-Mann, Mr. Prouty

111 (I), 112 (II) WESTERN CIVILIZATION

The historical development of European civilization, ideas and institutions, including America's place in the Western World.

3 hours, 4 credits

Mr. Bachman, Mr. Gagnon, Mrs. Watkins,
others

115 (I) EAST ASIAN CIVILIZATION

An introduction to the traditional civilizations of China and Japan from the earliest times to the arrival of the Western powers.

Training in oral and written expression.

3 hours, 4 credits

Mr. Bix

116 (II) EAST ASIAN CIVILIZATION

The political, social, economic and intellectual problems resulting from the Western impact on China and Japan, as well as Korea and Vietnam.

Training in oral and written expression.

3 hours, 4 credits

Mr. Bix

117 (I) INTRODUCTION TO AFRICAN CIVILIZATION I

The internal dynamics of pre-colonial African societies arising from the Bantu migrations, the rise and fall of the kingdoms of Ghana, Mali and Songhai, the city-states of Kilwa and Zanzibar, the development of the slave trade, and the influence of religion on tribal societies.

Training in oral and written expression.

3 hours, 4 credits

Mr. Amiji

118 (II) INTRODUCTION TO AFRICAN CIVILIZATION II

The interaction between the West and Africa in the nineteenth and twentieth centuries. The African response to European Imperialism, social and economic changes under colonialism, the development of nationalism

and the struggle for independence, Africa, and Afro-American, and Pan-Africanism. Training in oral and written expression. 3 hours, 4 credits Mr. Amiji

MAJOR HISTORICAL FORCES

122 (I) SCIENCE TECHNOLOGY AND THE MODERN WORLD

The importance of science and technology to the evolution of industrial society in the West, the relationships between scientific discovery and technological growth, and the relation of scientific and technological change to evolving social forms and types of economic organization.

3 hours, 4 credits Mr. Robinson

123 (I) REVOLUTIONS IN MODERN HISTORY

Comparative study of the English, French, Russian, and Chinese Revolutions. The question of historical change and the factors which made such changes "revolutionary." Based on works of historical analysis, contemporary documents and visual materials. Training in oral and written expression.

3 hours, 4 credits

Miss Gordon, Mr. Hunt, others

PROBLEMS AND PERIODS IN EUROPEAN HISTORY

128 (I), 129 (II) MAJOR PROBLEMS IN MODERN EUROPEAN HISTORY

First semester: a survey of the most important developments in European history from the French Revolution to the present. Second semester: several topics examined in depth and from different perspectives. Examples *might* be the impact of industrialization on the working class, the role of nationalism, the nature and impact of imperialism, the effect of the Russian Revolution on the non-western world, the nature and origins of fascism, the origins and development of the Cold War, and the relation of Marxist theory to Communist practice.

Training in oral and written expression.

3 hours, 4 credits

Mr. DiScala, Miss Schneider, others

ADVANCED HISTORY

207 (II) INTRODUCTION TO CLASSICAL ARCHEOLOGY

Offered jointly by the Art and History Departments. A survey of the art, archeology and history of Bronze Age Greece and Asia

Minor. Introduction to the methods and aims of archeology and to the geographical and historical background of the period. The major area cultures: the Minoan civilizations, Mycenaean Greece, Troy, and the Hittite Empire. Mr. Foss, Mr. Ramage

208 (I) GREEK HISTORY

A survey of the origin, rise and development of ancient Greek civilization from the arrival of the Greeks in Europe until the death of Cleopatra. Emphasis on the rise of the Greek city-state and the spread of Greek culture to the East.

Mr. Foss

209 (II) ROMAN HISTORY

The Roman state from its origins until the triumph of Christianity. Republic and Empire will receive equal attention. Closely related to History 208, the two courses provide a continuous history of the Mediterranean world from about 700 B.C. to 300 A.D.

Mr. Foss

210 (I) EARLY MIDDLE AGES

Medieval history from Marcus Aurelius to approximately 1000 A.D.

Mr. Percy

211 (II) LATER MIDDLE AGES

Medieval history from 1000 A.D. to the Italian Renaissance.

Mr. Percy

212 (I), 213 (II) AGE OF THE RENAISSANCE AND REFORMATION

Men, ideas, and institutions of 14th century through 16th century Europe.

Mrs. Watkins

215 (I) EIGHTEENTH CENTURY EUROPE: EUROPE IN THE AGE OF ENLIGHTENMENT

The main currents of European thought in their historical setting.

Mr. Grossmann

217 (I) EUROPE IN THE NINETEENTH CENTURY I

A political, social and cultural history of Europe from 1815 to 1871, including the history of each major European nation.

Mr. Powers

218 (II) EUROPE IN THE NINETEENTH CENTURY II

A political, social and cultural history of Europe from 1871 to 1914, including the history of each major European nation.

Mr. Powers

219 (I), 220 (II) EUROPE IN THE TWENTIETH CENTURY

Political, economic, social, and intellectual history of Europe, with attention to extra-European influences. From 1900 to 1939 in the first semester, 1939 to the present in the second.

Mr. Jefferson

221 (I) TUDOR-STUART ENGLAND

An introduction to English history before 1689; emphasis on the political crises of the sixteenth and seventeenth centuries.

Prerequisite: Introductory History or Departmental approval

Mr. Moffett

222 (II) ENGLAND IN THE AGE OF REVOLUTION

English history since 1689, with emphasis on the transformation of life and institutions in the eighteenth and nineteenth centuries.

Prerequisite: Introductory History or Departmental approval

Mr. Moffett

223 (I) EARLY MODERN FRANCE: RENAISSANCE TO REVOLUTION

Social structure, political institutions and events, economic developments and intellectual movements from the late fifteenth century to the end of the Ancien Régime.

Mr. Segal

224 (II) FRANCE: 1815 TO THE PRESENT

The development of parliamentary institutions and crises in their social, economic and intellectual settings; France's role in the world.

Mr. Gagnon

225 (I), 226 (II) RUSSIAN HISTORY

A survey of the political, economic, social and intellectual development of Russia, from Kiev to the emancipation of the serf (1861) in the first semester, through the Soviet Union in the Second World War in the second.

Mr. Schatz, Mrs. Kingston-Mann

227 (I) GERMAN HISTORY TO 1815

Medieval origins of Germany, the Reformation, the rise of Brandenburg-Prussia, the German Enlightenment, Germany and the French Revolution.

Mr. Bookbinder

228 (II) GERMAN HISTORY SINCE 1815

German liberalism, nationalism, conserva-

tism in nineteenth century, revolution of 1848, unification, World War I, Weimar, and the Nazi period.

Mr. Bookbinder

229 (I) THE HISTORY OF ITALY: FROM THE RENAISSANCE TO 1870

Developments in Italy from the end of the Renaissance to 1870, with emphasis on the eighteenth century and the Risorgimento.

Mr. DiScala

230 (II) HISTORY OF ITALY, 1870 TO THE PRESENT

Italian history since 1870, including an examination of Giolittian, Fascist and Republican Italy.

Mr. DiScala

231 (II) IRISH HISTORY, 1688-1923

The forces and movements which contributed to the development of Irish nationalism and the achievement of national independence.

Mr. McCahill

235 (II) THE BALKANS SINCE 1750

Introduction to Balkan geography and ethnography. Stresses the political, economic, social and cultural development of the nationalities and then the national states.

Mr. Pinson

236 (I) CENTRAL EUROPE, 1815 TO THE PRESENT

The Habsburg monarchy and its successor states. Topics include the problems of a multinational area in an age of nationalism, the interaction between the Great Powers and the Danubian region, World War I and the fall of the Austro-Hungarian Empire, and the role of democracy, fascism and communism in twentieth-century Central Europe.

Staff

237 (I) JEWISH HISTORY: ANTIQUITY TO THE LATE MIDDLE AGES

Survey of the political, social, and cultural history of the Jews from the origins of the Hebrew people to 1492. Attention to the Western and non-Western setting of Jewish society, and its interaction with ancient Near Eastern, Graeco-Roman, Muslim, and Christian societies and cultures.

Mr. Segal

**238 (II) JEWISH HISTORY:
FROM THE SPANISH EXPULSION
TO MODERN STATEHOOD**

Political, social, and intellectual developments in Jewish society in Western and Eastern Europe and the Near East from the late 15th century to the creation of Israel in 1948. Attention will be paid to Jewish experience in the age of humanism, and Reformation, Marranos and messianism, Enlightenment, Emancipation and Assimilation, 19th century responses to modernism, and the Jewish experience in the 20th century.

Mr. Segal

**239 (I) THE MIDDLE EAST,
622-1517**

Interaction between Islamic Society and the West for the rise of Islam (622) to the Turkish conquest of Egypt.

Mr. Ahmad, Mrs. Hoffman

**240 (II) THE MIDDLE EAST,
1517 TO THE PRESENT**

The Middle Eastern response to the West in the age of European expansion and domination.

Mr. Ahmad, Mrs. Hoffman

**243 (I) PROBLEMS IN AFRICAN
CIVILIZATION**

Intensive study of the interaction between Islam as a socio-political and spiritual phenomenon and traditional African societies. Problem oriented, rather than chronological, approach. The origins and spread of Islam to Sub-Saharan Africa, patterns of Islamization, growth of centralized political institutions, the role of Muslim Brotherhoods, Mahdism and messianic movements, development of Afro-Islamic literature and scholarship - Swahili, Hausa and Arabic, and the influence of Islam on modern nationalism and Pan-Africanism.

Mr. Amiji

244 (II) HISTORY OF EAST AFRICA

Modernization and social change in Kenya, Uganda and Tanzania. Such topics as the proto-nationalist movements of the nineteenth century, the politics of survival in the inter-war period, the problems of European and Indian settlers, the development of political parties and liberation movements, particularly the Mau Mau movement, African socialism, and the problems of ethnicity and national integration.

Mr. Amiji

**248 (I) HISTORY OF MODERN
JAPAN**

Commencing with the Tokugawa legacy, the

course surveys Japanese history from 1868 to the present day. The development of government institutions, politics and foreign relations as well as economic, social and intellectual changes.

Mr. Bix

**249 (II) HISTORY OF
CONTEMPORARY EAST ASIA**

Case studies of Japan, Korea, the Philippines and Indochina since World War II. The American occupation of Japan; the factors involved in its resurgence in the 50s and 60s; the colonial heritage in Korea, the Philippines and Indochina as background for the study of war, revolution and modernization in these areas.

Mr. Bix

265 (I), 266 (II) AMERICAN HISTORY

A survey of American history from 1763 to the present. The expansion and consolidation of the American Union, the development of national and international policies and the cultural and economic forces that shaped them.

3 hours, 4 credits

Staff

**270 (I) AMERICAN COLONIAL
HISTORY: THE EARLIEST
SETTLEMENTS TO 1763**

The English background of emigration and settlement. The evolution of imperial institutions, American social, economic, and religious development; emphasis on political ideas, institutions and behavior in the 17th and 18th centuries.

Mrs. Maier

**271 (II) AGE OF THE
AMERICAN REVOLUTION:
1763-1789**

The development of the conflict with Britain, 1763-1776; the Revolutionary War and its effects; the forming of republican institutions for state and Federal governments.

Mrs. Maier

**273 (I) THE AGE OF JACKSON
AND LINCOLN**

A social, economic, political and cultural history of the United States from 1815 to 1861.

Mr. Ruchames

**274 (II) CIVIL WAR AND
RECONSTRUCTION HISTORY**

Causes of the Civil War, its social, political, and ideological history, and the problems and results of Southern reconstruction.

Mr. Ruchames

**276 (I) THE UNITED STATES IN
THE TWENTIETH CENTURY,
1900-1937**

American politics and culture from the Progressive Period through the New Deal.

Prerequisite: History 126 or permission of instructor
Mr. Brown

**277 (II) THE UNITED STATES IN
THE TWENTIETH CENTURY,
1937-1969**

American politics and culture from the New Deal to the present.
Mr. Brown

282 (I) COLONIAL LATIN AMERICA

The imposition of Spanish and Portuguese institutions on the pre-Columbian civilizations in the New World, and the economic, social, religious, political, and cultural institutions that developed in Latin America. Emphasis on the differences and similarities between Colonial Latin America and other contemporary and later empires.

Miss Schneider

**283 (II) LATIN AMERICA:
INDEPENDENCE TO THE
PRESENT**

The histories of Mexico, Argentina, Brazil and Cuba since 1800. Emphasis on British and American economic expansion into these countries during the 19th and 20th centuries, and the resulting political and social consequences.

Miss Schneider

**308 (I) DIPLOMATIC HISTORY
OF EUROPE: 1815-1914**

The diplomacy of the Concert of Europe, the Eastern Question and Bismarck and of imperialism leading to the outbreak of war in 1914.

Mr. Ahmad

**309 (II) DIPLOMATIC HISTORY OF
EUROPE: 1914 TO THE PRESENT**

The system of collective security set up after World War I, and the failure of this system before the Second World War. Discussion of the origins and consequences of the Cold War.

Mr. Ahmad

**310 (I) ECONOMIC HISTORY OF
WESTERN EUROPE TO 1750**

The economics of Western Europe from 500 to 1750.

Mr. Bachman

**311 (II) ECONOMIC HISTORY OF
WESTERN EUROPE, 1750
TO THE PRESENT**

The economics of Western Europe from 1750 to the present.

Mr. Bachman

**314 (I) HISTORY OF EUROPEAN
IDEAS I**

Main currents of European thought in the Seventeenth and Eighteenth Century.

Mr. Powers

**315 (II) HISTORY OF EUROPEAN
IDEAS II**

Main currents of European thought in the Nineteenth and early Twentieth Century.

Mr. Powers

**320 (I) HISTORY OF AMERICAN
FOREIGN POLICY, 1763-1900**

Survey of United States foreign policy and relations with the rest of the world, from the colonial period to the end of the nineteenth century; emphasis on domestic sources of foreign policy and U.S. expansionism.

Mr. Remsburg

**321 (II) HISTORY OF AMERICAN
FOREIGN POLICY, THE TWENTIETH
CENTURY**

Survey of United States foreign policy and diplomatic relations with other powers from the turn of the century to the 1960s. Emphasis on domestic sources of foreign policies and on general topics such as World Wars I and II, Cold War diplomacy, and the debate over America's role in world affairs.

Mr. Remsburg

**324 (I) AMERICAN SOCIAL HISTORY
TO THE CIVIL WAR**

The emergence of social institutions in America from the establishment of colonies to the mid-nineteenth century.

Mr. Feldberg

**325 (II) AMERICAN SOCIAL HISTORY
FROM THE CIVIL WAR TO THE
PRESENT**

The American Dream as it has related to institutions and ethnic groups in twentieth century U.S.

Mr. Feldberg

**326 (I), 327 (II) HISTORY OF
AMERICAN THOUGHT**

Ideas in America — religious, scientific, polit-

ical, social and economic — from the colonial period to the Civil War in the first semester, and from the end of the Civil War to the New Deal in the second semester.

Mr. Boller

328 (I) BLACK HISTORY IN AMERICA

The history of Black people in America from African origins through the conclusion of Reconstruction in 1877. The development of slavery in the South and life in the cities of the North, particularly through original accounts by Black Americans.

Mr. Stern

329 (II) BLACK HISTORY IN AMERICA

The experience of Black Americans from the rise of Jim Crow after 1877 through the emergence of the black challenge to American racial values and institutions in the 1950s and the 1960s.

Mr. Stern

332 (I) MEDIEVAL LAW

The principles underlying the evolution of law in western Europe. Emphasis on England during the Middle Ages. Some of the legal concepts and procedures necessary in understanding medieval history and common law.

Recommended for pre-law students.

Mr. Percy

333 (II) THE MEDIEVAL MIND

Through literary, philosophical, and religious masterpieces from the period, this interdisciplinary seminar probes the culture which created the modern West and considers the differences between its modes of thought and moral values and ours.

Mr. Percy

334 (I) THE SOCIAL AND ECONOMIC TRANSFORMATION OF EUROPE

Europe's industrial revolution; fundamental social changes associated with industrialization (in demographic régime, family structure, social stratification, etc.); consideration of the nature, growth, and decline of *laissez-faire*.

Mr. Bachman

335 (I) SCIENCE AND TECHNOLOGY IN THE INDUSTRIAL REVOLUTION IN BRITAIN

The social and economic effects of science and technology during the Industrial Revolution, and some of the consequences for

education. The implications for some of Britain's leading industries of the change-over to steampower and to new chemical processes. Special case study of the important engineering firm, Boulton and Watt. No special knowledge of science required.

Mr. Robinson

336 (I) ARTISANS AND PEASANTS IN EARLY MODERN EUROPE

An analysis of the consciousness, the family and community organization, and the political activity of peasants and artisans in 17th and 18th century Europe.

Mr. Hunt

338 (I) THE BRITISH EMPIRE, 1700-1900

An historical study of selected topics and problems in the economy, polity, and ideology of the eighteenth and nineteenth century British Empire and a review of the British role in the world economy.

Mr. Prouty

342 (I) BRITAIN IN THE TWENTIETH CENTURY

A survey of political and social change in Britain since 1900.

Staff

346 (II) HISTORY OF THE RUSSIAN INTELLIGENTSIA: EIGHTEENTH CENTURY TO THE PRESENT

Rise and development of political dissent in Russia from its origins in the eighteenth century to its revival after the death of Stalin.

Mr. Schatz

347 (I) THE RUSSIAN REVOLUTION — 1917

The origins and development of the Russian Revolution, with special emphasis on the questions of war, property, and constitutional freedom that divided pre-revolutionary opponents of the Tsarist regime in 1917.

Mrs. Kingston-Mann

354 (II) VIENNA — 1900

Vienna, capital of the Austro-Hungarian empire at the turn of the century, a time of political disintegration, when it became the center of new pioneering, intellectual, scientific, and aesthetic activities. Mr. Grossmann

358 (II) MARX AND FREUD: STUDIES IN MODERN INTELLECTUAL HISTORY

The dynamic tensions between the two traditions of enlightenment rationalism and early nineteenth-century romanticism within the

thought of Marx and Freud; an attempt to determine whether these two major systems of thought can be reconciled and synthesized, or whether they must remain philosophical antagonists. Mr. McCarthy

359 (II) HISTORY OF SOCIALISM

An introduction to socialism as a critique of capitalism and as an alternative form of social-economic organization, through an intensive reading of the works of representative theorists of 19th-century socialism, such as Saint-Simon and the Saint-Simonians, Fourier, Marx and Engels, Kropotkin, Bernstein, and Lenin. Attention to the historical conditions which influenced the development of socialist theory and which underlie the most significant conflicts and controversies in the history of the socialist movement. Mr. McCarthy

375 (I) HISTORY OF AFRICA FROM 632 TO 1870

The impact of Islam on Africa, the Bantu migrations, the rise and fall of African kingdoms and city-states, the era of the slave trade, nineteenth century reformist movements in Eastern and Western Sudan, and interaction between traders, missionaries and African societies. Mr. Amiji

376 (II) HISTORY OF AFRICA FROM 1870 TO THE PRESENT

The European conquest and partition of Africa, the establishment of European rule and African response to colonialism, forms of native administrative policies, socio-economic changes in African societies, growth of African nationalism, the emergence of independent African states and problems of decolonization. Mr. Amiji

400 (I), 401 (II) SPECIAL PROBLEMS

Guided reading and research; may be used in Departmental Honors program. Prerequisite: Senior standing; History major Staff

403 (I, II) SEMINAR IN EUROPEAN HISTORY

A problem course intended to give training in historical research and writing. The field varies each semester. Staff

404 (I, II) SEMINAR IN AMERICAN HISTORY

Similar to History 403, but dealing with American history. Staff

HUMANITIES

COURSE OFFERINGS

(3 hours, 3 credits each, unless specified)

109 (I, II) PATTERNS OF RELIGIOUS MEANINGS AND ACTION

An introductory and survey course in religion. Comparative and interdisciplinary approach. Begins with primitive and archaic religion (including myth and ritual), and concentrates on two or three of the world-historical religions (e.g., Buddhism, Judaism, Christianity—including mysticism and millenarianism) and on contemporary religious phenomena. Mr. Williamson

114 (I, II) MASTERPIECES OF WESTERN LITERATURE

Selected works in various genres and from various periods by such major writers as Homer, Sophocles, Dante, Shakespeare, Goethe, Tolstoy, and Faulkner. Special attention to writing. 3 hours, 4 credits Prerequisite: English 102 Mr. Gittleman, Mr. Nelson

231 (I) HINDU RELIGION

The patterns of religious meaning and action in Indian Hindu culture as expressed in myth, literature and art. Equal attention to traditional material, such as the Upanishads and the Bhagavad Gita, and to recent figures and movements, such as Tagore and Gandhi. Staff

232 (II) BUDDHIST RELIGION

The various forms of Buddhism; its background in archaic Indian religion; the different types of Buddhist teaching; mysticism and practices in India, Ceylon, S.E. Asia, China, and Japan (i.e., Theravada, Mahayan, Madhyamika, Yogacharin, Zen and Pure Land Buddhism). Staff

241 (I) INTRODUCTION TO BIBLICAL LITERATURE: OLD TESTAMENT

Reading of representative texts for the Old Testament and introduction of the characteristic problems in interpreting those texts. Staff

242 (II) INTRODUCTION TO BIBLICAL LITERATURE: NEW TESTAMENT

Reading of representative texts for the New

Testament and introduction to the character-
istic problems in interpreting those texts.

Mr. Horsley

243 (I) MYTHOLOGY AND LITERATURE

Classical, Celtic and other myths and their
persistence and transformation in English
and American literature.

Prerequisite: 1 soph. Eng. course

Mrs. Mendillo

244 (II) GERMANIC MYTHOLOGY

Norse and Teutonic Literature with empha-
sis on the *Prose Edda*, Southern Germanic
poems, the Icelandic Saga, the nature of
myth, and its survival in post-pagan times.

Mr. Ott

247 (II) READINGS IN EUROPEAN FICTION

The art and the thought of major European
novelists, including Dostoevsky, Tolstoy,
Flaubert, Stendhal, Gide, Mann, and Kafka.
Prerequisite: 1 soph. Eng. course

Mr. Stock

249 (I, II) AFRICAN LITERATURE

A survey of African literature. Includes such
writers as Yacine, Bourboune, Ouologuem,
Soyinka, Ngugi, p'Bitek, Paton and Abra-
hams.

Prerequisite: 1 soph. Eng. course

Mr. Senna

250 THE HERO IN MODERN EUROPEAN FICTION

A comparative study of the "hero" in
European literature since 1800. Four types
are explored: the Gothic hero, the Outsider
or Rebel, the Existential hero, and the mod-
ern Saint. Works by Kafka, Balzac, Dos-
toevsky, Rilke, Sartre, Nietzsche, D. H.
Lawrence, and Hesse.

Mr. Miles

252 (I) FILM STUDY I

An introduction to the history and art of the
film. Viewing and discussion of representa-
tive experimental, documentary, and feature
films, and reading in the literature of the
film. Critical papers required.

3 hours, 4 credits

Prerequisite: English 102

Mr. Risse

253 (II) FILM STUDY II

Work in both film analysis and film making;
detailed study of selected major works

chiefly from the contemporary cinema, and
a project in sound film production.

Prerequisite: Humanities 252 and permission
of instructor

Mr. Risse

254 (II) ROMANTICISM IN ITS EUROPEAN CONTEXT

The development of Romanticism in Europe.

Prerequisite: 1 soph. Eng. course

Mr. Ott

260 (I) VISIONARY AND PROPHECIC MODES IN LITERATURE

Visionary and prophetic experience as re-
flected in selected writings from such sources
as the Bible, Blake, Hesse, and primitive
poetry. Theoretical works about non-rational
perception; Tarot readings and the *I-Ching*.
Prerequisite: Permission of instructor

Mr. Schreiber

300 (I) COMPARATIVE HISTORY OF THE ROMANCE LANGUAGES

A comparative study of the evolution of
the Romance languages from Latin, with
analysis of the most representative texts from
each period and languages. Emphasis on
French, Italian and Spanish.

Mr. Giustiniani

383 (II) THE IMAGE OF WOMEN IN LITERATURE

Archetypes and stereotypes of women in
works by such writers as Chaucer, Shake-
speare, Flaubert, Hawthorne, James, Ibsen,
Chekhov, Hemingway, Faulkner, Mailer,
and Lessing.

Prerequisite: 1 soph. Eng. course

Mrs. Ferguson

RELATED COURSES:

Classics 111 Greek and Roman Epic Poetry

Classics 112 Greek and Roman Religion and

Mythology

Classics 121 Greek and Roman Tragedy

Classics 122 Greek and Roman Comedy

Classics 331 (I) Greek and Roman

Civilizations

Classics 392 Women in Greek and Roman
Literature

Classics 394 Literary Criticism in

Antiquity

French 161 (I) Twentieth Century French
Novel

French 162 (II) Contemporary French
Theatre

French 163 (I) Political Trends in the
Creative Arts in Twentieth Century
France

French 164 (II) French Existential
Literature

French 165 (I) Masterpieces of French Literature
 French 260 The Nineteenth Century French Novel in Translation
 French 261 (I) Modern French Novel in Translation: 1900-1935
 French 262 (II) Modern French Novel in Translation: 1935 Until the Present
 French 263 (I) The Black Soul and the Theatre
 German 150-1 (I) Goethe and His Age
 German 151-1 (II) The Crisis of Moral Relativism in Modern German Literature
 German 151-2 (II) Nietzsche and the German Arts
 German 152 (II) East Versus West in Contemporary German Literature
 German 241 (I) German Civilization I
 German 242 (II) German Civilization II
 German 251 (I) Aspects of Modern German Literature
 German 255 (II) Hesse, Mann and the Modern Romantic Imagination
 German 256 (II) Faust: Origin, Legend and the Literary Tradition
 German 257 (II) Brecht and the Modern Theater
 German 258 (I) Germany in the 20th Century: Weimar and Nazi Culture
 Italian 161 (I) The Contemporary Italian Novel
 Italian 162 (II) The Theater of Italy
 Italian 165 (I) Masterpieces of Italian Literature
 Italian 166 (II) Political Thought in Italian Literature
 Russian 221 (I), 222 (II) Russian Literature in Translation
 Russian 263 (II) Russian Culture and Civilization
 Russian 264 (I) Bulgakov, Pasternak, and Solzhenitsyn
 Russian 265 (I) Chekhov
 Russian 353 (I) Dostoevsky
 Russian 354 (II) Tolstoy
 Russian 355 (II) Soviet Literature
 Russian 356 (I) Russian Drama
 Spanish 131 (I), 132 (II) Introduction to Hispanic Literature in Translation
 Spanish 261 (I) Spanish Masterpieces in Translation
 Spanish 262 (II) Modern Spanish-American Literature in Translation

ITALIAN COLLEGE I

VITO R. GIUSTINIANI, Dottore in lettere e

filosofia, Professor of Italian and Chairman of Italian, College I; GERALD C. VOLPE, PH.D., Assistant Professor of Italian and French; ANTONIO F. CARRARA, M.A., GIOVANNI CATALANI, M.A., LAWRENCE KABAT, M.A., Instructors in Italian.

GRADUATION REQUIREMENTS

Majors are required to take a minimum of 30 credits in Junior-Senior level courses in Italian, including Italian 241-42 (or its equivalent). All majors must have taken Italian 231 (or its equivalent) as prerequisite for advanced literature courses.

At the end of the Senior year, majors are encouraged to take a comprehensive oral and written examination in Italian, both as an academic experience summing up their Italian studies and as qualification for the University and Departmental awards in Italian. The examination would cover three specific fields of Italian literature (to be chosen by the student from among: 1. Il Duecento e Il Trecento; 2. Umanesimo e Rinascimento; 3. Il Seicento e Il Settecento; 4. Romanticismo e Risorgimento; 5. Il Novecento) but the student would be expected to have some knowledge of the course and direction of Italian literature in general. Students who wish to take the examination should consult the academic adviser at the beginning of the Spring semester of the Senior year.

Departmental Honors. To graduate with honors, a student must: 1. achieve a 3.5 grade average in his Italian studies; 2. submit to the Italian Department a short research paper written during the second semester of his Senior year under the supervision of a Departmental adviser; 3. take the comprehensive examination; 4. be recommended by the Departmental Honors committee; 5. attain a 3.0 overall grade average.

The student may elect to discuss his Honors paper in an open Departmental meeting instead of taking the oral part of the comprehensive examination.

The Department grants 6 credits towards the total 30 major credits for

successful completion of the Honors program.

COURSE OFFERINGS

(3 hours, 3 credits each, unless specified)
Course numbers 161, 162, 165 and 166 are literature courses in translation. They satisfy the language requirement. All other courses are given in Italian.

111 (I), 112 (II) ELEMENTARY ITALIAN

For students who have no creditable training in Italian, intensive practice in the four language skills, with an audio-lingual approach.

4 hours, 2 hours laboratory

4 credits each semester Staff

121 (I), 122 (II) INTERMEDIATE ITALIAN

An intensive review of grammar and further study of audio-lingual skills with correlated readings in Italian literature.

4 hours, 2 hours laboratory

4 credits each semester

Prerequisite: Italian 112 or equivalent Staff

161 (I) THE CONTEMPORARY ITALIAN NOVEL

An analysis of the leading artistic and social problems of the twentieth century in such representative authors as Levi, Vittorini, Moravia, Silone, Svevo, Pavese, Pasolini, and Pratolini.

(Readings and discussions in English.)

3 hours, 4 credits Mr. Kabat

162 (II) THE THEATER OF ITALY

The evolution of the theater from the Renaissance to the avant-garde.

(Readings and discussions in English.)

3 hours, 4 credits Mr. Volpe

165 (I) MASTERPIECES OF ITALIAN LITERATURE

Some of the representative authors from the Middle Ages to modern times.

(Readings and discussions in English.)

3 hours, 4 credits Staff

166 (II) POLITICAL THOUGHT IN ITALIAN LITERATURE

Political ideas from medieval universalism to modern nationalism.

(Conducted in English)

3 hours, 4 credits Mr. Giustiniani

231 (I), 232 (II) INTRODUCTION TO ITALIAN CULTURE THROUGH LITERATURE

A survey of Italian literature as a reflection of the civilization from the Renaissance to the modern period.

Prerequisite: Italian 122 or equivalent

Mr. Carrara and Staff

241 (I) ITALIAN COMPOSITION AND CONVERSATION

An intensive review of grammar, exercises in free composition, and conversational practice.

Prerequisite: Italian 122 or equivalent and Departmental permission Mr. Carrara

242 (II) LITERARY THEORIES AND TECHNIQUES AND BIBLIOGRAPHY

A survey of literary theories and an introduction leading towards the acquisition of bibliographical skills.

Prerequisite: Italian 241 or equivalent and Departmental permission Mr. Giustiniani

300 (I) DANTE AND THE DUECENTO

Dante's lyric poems examined in the light of the Italian lyrical tradition from the Sicilian School to the *Dolce Stil Nuovo*.

Prerequisite: Italian 231 and Departmental permission Mr. Carrara

301 (I), 302 (II) LECTURA DANTIS

Selections from the minor works of Dante and from his contemporaries as an introduction to the study of the *Commedia*. The first semester is devoted to the "*stil novo*", the *Vita Nuovo*, and the *Inferno*; the second to the *Purgatorio* and the *Paradiso*.

Prerequisite: Italian 231 or equivalent and permission of instructor Mr. Volpe

305 (I) PETRARCA AND BOCCACCIO

An analysis and discussion of the works of these two masters as they reflect the Humanist rejection of medieval mysticism and preoccupation with man's earthly condition.

Prerequisite: Italian 231 or equivalent and permission of instructor Mr. Carrara

311 (I) THE AGE OF HUMANISM IN ITALY

The Humanist literature of the Italian Renaissance in the light of the intellectual and artistic preoccupations of the Age.

Prerequisite: Italian 231 or equivalent and permission of instructor

Mr. Giustiniani

312 (II) THE ITALIAN RENAISSANCE
Machiavelli, Castiglione, Ariosto, and Tasso as exponents of the multiple aspirations and achievements of Italy's Golden Age.

Prerequisite: Italian 231 or equivalent and permission of instructor

Mr. Giustiniani

315 (II) THE RENAISSANCE EPIC

The evolution of the Epic Poem in Italian Literature during the Renaissance: Pulci, Boiardo, Ariosto, Tasso.

Prerequisite: Italian 231 and Departmental permission

Mr. Volpe

331 (II) ITALIAN LITERATURE OF THE 17TH AND 18TH CENTURIES

Marino, Vico, Goldoni, Parini, and Alfieri as examples of the development from the extravagance of the Baroque to the rationalism of the Age of Enlightenment.

Prerequisite: Italian 231 or equivalent and permission of instructor

Staff

341 (I) NEO-CLASSICISM AND ROMANTICISM

An analysis of this complex movement in its exaltation of liberty and imagination during the revolutionary period of the Risorgimento when Italy became a nation. Monti, Foscoli, Leopardi, and Manzoni.

Prerequisite: Italian 231 or equivalent and permission of instructor

Staff

351 (I) THE MODERN ITALIAN NOVEL

An analysis of the post-romantic literary trends such as "verismo", "regionalismo", and "neo-realismo". Some of the authors to be studied are Verga, Svevo, Pirandello, and Silone.

Prerequisite: Italian 231 or equivalent and permission of instructor

Staff

352 (II) THE CONTEMPORARY ITALIAN NOVEL

Such trends as "Letterature di costume", "Il romanzo psicologico", and "I Mimetici" and the avant-garde movements considered in the writings of Levi, Vittorini, Moravia, Pasolini, and others.

Prerequisite: Italian 231 or equivalent and permission of instructor

Mr. Carrara

361 (I) MODERN ITALIAN POETRY

A survey of the principal poets from Carducci to Saba, with emphasis on hermeticism.

Prerequisite: Italian 231 or equivalent and permission of instructor

Staff

365 (II) LETTERATURA DIALETTALE ITALIANA

The impact of dialect poetry in Italian Literature particularly in the Romantic period, in relation to the Italian "Questione Della Lingua".

Prerequisite: Italian 231 and Departmental permission

Mr. Giustiniani

381 (I), 382 (II) READING AND RESEARCH

Especially recommended to Seniors, Independent study and frequent consultations with a Departmental adviser on a fairly broad aspect of Italian literature of special interest to the student.

Prerequisite: Departmental permission

Staff

386 (II) METHOD AND PRACTICE TEACHING OF ITALIAN IN SECONDARY SCHOOLS

The issues, principles and methods of secondary school Italian language teaching. Supervision and critique of practice teaching.

3 hours, 20 hours laboratory (practice teaching), 9 credits

Prerequisite: 6 hours Education courses and admission to Teacher Certification Program.

Staff

391 (I), 392 (II) HONORS THESIS IN ITALIAN

Independent and original investigation of a specific aspect of Italian literature of special interest to the student, under the supervision of a Departmental adviser.

Prerequisite: Departmental permission

Staff

MATHEMATICS

COLLEGE I

ALFONSO G. AZPEITIA, PH.D., Professor of Mathematics and Chairman of Mathematics, College I; HERBERT KAMOWITZ, PH.D., Professor of Mathematics; JUAN CARLOS MERLO, PH.D., JOHN A. LUTTS, PH.D., ELIZABETH J. O'NEIL, PH.D., Associate Professors of Mathematics; JAMES S. BYRNES, PH.D., CARL COHEN, M.A., DANIEL COMENETZ, PH.D., SO-FEI FANG, PH.D., JOAN LUKAS, PH.D., SOME NATH MUKHERJEE, PH.D., SHERWOOD WASHBURN, PH.D., Assistant Professors of Mathematics; JOE E. CRICK, M.A.T.,

JOSEPH RUSSELL, M.A., VERA WIDDER, PH.D., Part-time Lecturers in Mathematics.

COLLEGE II

TAFFEE T. TANIMOTO, PH.D., Professor of Mathematics and Chairman of Mathematics, College II; MATTHEW P. GAFFNEY, PH.D., GEZA SCHAY, PH.D., Professors of Mathematics; BERNICE AUSLANDER, PH.D., ERNEST ELYASH, PH.D., STEPHEN K. PARROTT, PH.D., Associate Professors of Mathematics; LAZARO RECHT, PH.D., HELEN SKALA, PH.D., MICHAEL TOMLINSON, PH.D., JAMES N. WHITNEY, PH.D., Assistant Professors of Mathematics; M. COLIN GODFREY, M.A., MARK LEVINE, M.A., DENNIS H. WORTMAN, B.S., Instructors in Mathematics.

GRADUATION REQUIREMENTS

All Mathematics majors are required to take Math 111 and 112 or Math 105, 106 and 150, or their equivalent; Math 151; eight courses above Math 151 (no grade of "P" accepted); and Physics 111 and 112.

COURSE OFFERINGS

(3 hours, 3 credits each, unless specified)
The prerequisite for all introductory level courses, unless otherwise stated, is two years of algebra and one year of plane geometry.

100 (I, II) LIBERAL ARTS MATHEMATICS I

An historical-cultural survey of the main areas of mathematics. Emphasizes the interplay of these areas with man's philosophic, artistic, commercial, and scientific pursuits.
3 hours, 4 credits
Prerequisite: Permission from Mr. Lutts

Staff

101 (I, II) LIBERAL ARTS MATHEMATICS II

A primarily descriptive survey of several areas of mathematics. Stresses understanding through concrete examples. Topics include elementary number theory, elementary finite group and non-Euclidean geometry and how they relate to the physical world.
3 hours, 4 credits

Mr. Lutts, Mr. Cohen

102 (I, II) FINITE MATHEMATICS

For non-science or non-mathematics majors. Topics include elementary set theory; combinations, permutations and other "counting" formulas; discrete probability theory; random variables and their distributions.
3 hours, 4 credits

Staff

103 (I, II) PRE-CALCULUS MATHEMATICS

Review of algebra and trigonometry for students with two years of high school algebra. Intended for interested students or students who plan to major in mathematics and science but have weak backgrounds.

Staff

104 (I, II) SURVEY OF CALCULUS

Calculus developed intuitively and applied to problems in geometry, physics, and probability. A terminal course for non-science and non-mathematics majors.

3 hours, 4 credits

Staff

105 (I, II) CALCULUS I

The first in the calculus sequence of courses for science and mathematics majors. Starts with the basic concepts of functions and limits. Topics include derivatives and their applications and definite and indefinite integrals with application to geometrical and physical problems, discussing simple algebraic and transcendental functions.

3 hours, 4 credits

Prerequisite: Equivalent of Math 103

Staff

106 (I, II) CALCULUS II

Continuation of Math 105. Topics are integration, applications of the integral, sequences and series.

3 hours, 4 credits

Prerequisite: Math 105 or equivalent

Staff

107 (I, II) INTRODUCTION TO COMPUTER CONCEPTS

Discussion of computer applications, components and terminology; historical and recent developments, computer "arithmetic", data processing equipment and its uses, computer languages.

Prerequisite: Permission from Mr. Lutts

Staff

108 (I, II) INTRODUCTION TO MATHEMATICAL COMPUTER PROGRAMMING

A detailed introduction to algorithms and problem-solving techniques, description of

one or more algebraic languages, programming experience, and "de-bug" several programs during the semester.

Prerequisite: Math 103 Staff

111 (I) UNIFIED CALCULUS I

The first semester of a two semester concentrated calculus sequence for science and mathematics majors. Basic concepts of functions and limits. Topics include derivatives and their applications. The definite and indefinite integrals with applications to geometrical, statistical, and physical problems. Detailed consideration of transcendental functions, sequences and series.

5 hours, 5 credits Staff

112 (II) UNIFIED CALCULUS II

Topics include vector calculus and integration techniques. Multivariate calculus including partial differentiation and multiple integration with applications to many fields.

5 hours, 5 credits

Prerequisite: Math 111 Staff

150 (I, II) CALCULUS III

An introduction to linear algebra with applications to multivariate calculus, sequences and series, partial differentiation and application to physics and geometry.

Prerequisite: Math 106 Staff

151 (I, II) DIFFERENTIAL EQUATIONS AND ALLIED TOPICS

Linear differential equations of the first and second order, general theory of linear differential equations with physical applications.

3 hours, 4 credits

Prerequisite: Math 150 or equivalent Staff

152 (I, II) LINEAR ALGEBRA I

Linear geometry of finite vector spaces, linear independence spanning sets, basis, dimensionality, and theorems relating these concepts. Algebra of linear transformations and their matrices, invertability, eigenvalues, eigenvectors, and similarity.

3 hours, 4 credits

Prerequisite: Math 106 or equivalent Staff

153 (I, II) LINEAR ALGEBRA II

Groups, rings, polynomials, differential and integral linear operators; an introduction to inner spaces, exterior forms and multilinear algebra.

3 hours, 4 credits

Prerequisite: Math 152 Staff

155 (I, II) APPLIED MATHEMATICS ANALYSIS I

Comprehensive review of ordinary differential equations, series solutions, Bessel functions, characteristic functions, Fourier series.

Prerequisite: Math 151 Staff

156 (I, II) APPLIED MATHEMATICS ANALYSIS II

Partial differential equations by separation of variables, applications of the Green, Stokes and Gauss theorems, variation problems, introduction to complex functions with applications.

Prerequisite: Math 155 Staff

201 (I, II) ADVANCED CALCULUS I

Elementary topology, sequences, continuous functions and Riemann integrals in Euclidean spaces.

Note: Some topics listed under Math 201 may be covered in Math 202, and vice versa.

Prerequisite: Math 151

Prerequisite or corequisite: Math 152 Staff

202 (I, II) ADVANCED CALCULUS II

Partial differentiation and approximation by linear transformations, Implicit Function Theorem, some elementary differential geometry and Stokes' Theorem.

Prerequisite: Math 201 (suggested corequisite: Math 152) Staff

203 (I) ABSTRACT ALGEBRA I

Sets in logic, integers and congruences, lattices, finite groups.

Prerequisite: Math 151 Staff

204 (II) ABSTRACT ALGEBRA II

Rings, fields, vector spaces and quadratic forms, structure of groups, and introduction to multilinear algebra.

Prerequisite: Math 203 Staff

205 (I) PROBABILITY AND STATISTICS I

Discrete probability theory, some limit theorems, random variables and generating functions.

Prerequisite: Math 151 Staff

206 (II) PROBABILITY AND STATISTICS II

Renewal theory, application of renewal theory, stochastic processes. Elementary theory, continuous random variables and some statistical theory.

Staff

207 (I) THEORY OF COMPUTATIONS

Abstract models of computational processes, mathematical formulations of the notion of effective procedure. Unsolvable problems.

Prerequisite: Math 151 Staff

251 (I) AN INTRODUCTION TO REAL ANALYSIS

Real numbers, topology of reals, infinite series, continuity, Weierstrass approximation, differentiation, integration, power series, and orthonormal systems.

Prerequisite: Math 202 Staff

252 (II) AN INTRODUCTION TO COMPLEX ANALYSIS

Complex numbers, complex functions, power functions, trigonometric functions, Moebius transformations. Differentiation and integration of analytic functions, Cauchy's Theorem, residues, series and singularities, and meromorphic functions.

Prerequisite: Math 202 Staff

253 (I) TOPICS IN GEOMETRY I

Topics in classical Euclidean and non-Euclidean geometries, projective geometry, lattices, and finite geometries.

Prerequisite: Math 153 or 204 Staff

254 (II) TOPICS IN GEOMETRY II

An introduction to classical differential geometry with corresponding modern algebraic approaches leading to an introduction to Riemannian geometry. Techniques involve tensor analysis and multilinear algebra.

Prerequisite: Math 204 Staff

255 (I) MATHEMATICAL LOGIC

Formal theories, consistency, completeness, decidability, Godel's incompleteness theorem for first order arithmetic (Peano number theory). Introduction to axiomatic set theory, ordinal numbers, and cardinal numbers.

Prerequisite: Math 151 Staff

256 (II) MATHEMATICAL LOGIC II

Properties of formal theories. Godel incompleteness theorem for arithmetic. Decidability. Algorithms and their limitations.

Prerequisite: Math 255 Mrs. Lukas

258 THEORY OF NUMBERS

Prime numbers, congruences and residue. Approximation of real numbers by rationals. Diophantine equations.

Prerequisite: Math 151 Staff

262 (I) TOPOLOGY

Topological spaces, convergence and continuity, compactness and connectedness properties; introduction to Homotopy theory and combinatorial topology.

Prerequisite: 1 semester of Advanced Calculus Staff

264 (I, II) NUMERICAL ANALYSIS

Approximations of roots, finite differences, interpolation, numerical solutions of differential equations and algebraic equations. Students will have access to computer terminal.

Prerequisite: Math 151 Staff

290 (I) READING IN MATHEMATICS

Advanced level study of various topics according to individual interests. Open only to those students who have proven capabilities in mathematics.

Prerequisite: Permission of the Department Staff

386 (II) METHODS AND PRACTICE TEACHING OF MATHEMATICS IN SECONDARY SCHOOLS

Required for Math secondary teaching certification; also satisfies methods course required by Massachusetts for teaching. Advanced plane geometry and application with generalized interpretations of elementary high school topics. Algebraic topics such as symmetric functions, cyclic groups and algebraic number fields and their extensions, and classical standard problems, e.g., duplication of the cube, trisection of an angle, and squaring the circle.

3 hours, 20 hours laboratory (practice teaching), 9 credits

Prerequisite: Math 151 and 6 hours Education courses Staff

MASTER'S DEGREE PROGRAM

711 (I), 712 (II) INTRODUCTION TO MODERN ALGEBRA

Groups, rings, algebras, fields, modules, linear transformations and matrices, tensor products, homological algebra.

Prerequisite: Math 202 or equivalent Mr. Parrott

721 (I), 722 (II) THEORY OF FUNCTIONS OF A COMPLEX VARIABLE

Linear transformations of a complex variable, power series and elementary functions, holomorphic functions and Cauchy's Theorem, theory of residues, isolated singularities, con-

formal mappings, entire and meromorphic functions and their representations by means of products and partial fractions, elliptic functions, analytic continuation and Riemann surfaces, algebraic functions.

Prerequisite: Math 202 or equivalent

Mr. Azpeita

723 (I), 724 (II) THEORY OF FUNCTIONS OF A REAL VARIABLE

The real number system, Lebesgue measure and the Lebesgue integral, differentiation, the classical Banach spaces, general measure, and the integration theory.

Prerequisite: Math 202 or equivalent

Mr. Kamowitz

725 (I) TOPOLOGY

A one-semester graduate course in general topology. Topological spaces. Classification. Separation properties. Cartesian products. Mappings and continuity. Connectedness. General convergence. Compactness. Function spaces. Introduction to Homotopy theory.

Staff

727 (I), 728 (II) DIFFERENTIABLE MANIFOLDS I AND II

Differentiable manifolds, tangent spaces, tangent bundles, flows and vector fields, Lie derivatives, differential forms, generalizations of line and surface integrals, divergence theorem and Stokes' theorem, Riemannian manifolds, Riemann surfaces, relationships to vector analysis and to differential geometry.

Mr. Gaffney

729 (I) STOCHASTIC PROCESSES I

Probability spaces, measures, random variables. Various modes of convergence, laws of large numbers and of the iterated logarithm. Central limit theorem, conditioning, martingales.

Mr. Schay

730 (II) STOCHASTIC PROCESSES II

Processes with independent increments, Markov chains, stationary processes, continuous parameter Markov chains, diffusion processes. Sample paths, separability, semigroups, boundaries.

Mr. Schay

MUSIC

COLLEGE I

ROBERT PRINS, M.M., Associate Professor of Music and Acting Chairman of Music,

College I; JOHN HUGGLER, B.M., Associate Professor of Music.

COLLEGE II

NICHOLAS E. TAWA, M.A., Associate Professor of Music and Chairman of Music, College II; LAURENCE D. BERMAN, Ph.D., Associate Professor of Music; ROSEMARY LEAVENWORTH, M.M., Instructor in Music.

GRADUATION REQUIREMENTS

Music majors must take a minimum of 34 credits in music which must include Music 121-22, 221-22, and 202. All music majors will also be expected to take at least two courses in music history and literature.

It is recommended that all music majors acquire at least an elementary proficiency at the piano. A minimum of three years membership in a performing group is also urged.

Each student majoring in music will be assisted by a departmental adviser to plan a sequence of courses that will suit his own needs and satisfy the requirements of the Music Department.

COURSE OFFERINGS

(3 hours, 3 credits each, unless specified)

001 (I, II) CHORUS

3 hours, 1 credit

Mr. Prins

111 (I), 112 (II) INTRODUCTION TO MUSIC

Basic music materials, principles of design, and the cultural significance of representative works in historical sequence. Designed primarily for non-music majors.

3 hours, 4 credits

Mr. Prins and Staff

121 (I), 122 (II) FIRST YEAR THEORY

Harmony, melody, and music theory.

3 hours, 4 credits

Prerequisite: Permission of instructor

Mr. Prins

131 (I), 132 (II) ELEMENTS OF MUSIC

The function of scales, intervals, triads, chords in root position and inversions. Use of nonharmonic tones and modulation, correlated sight-singing, ear training, dictation,

analysis and keyboard drill. Designed primarily for music majors.

4 hours, 1 laboratory hour, 4 credits Staff

202 (I) INTRODUCTION TO MUSICAL RESEARCH I

Basic research materials and scholarly procedures.

Prerequisite: Music 111-112 or permission of instructor Mr. Tawa

221 (I), 222 (II) SECOND YEAR THEORY AND COMPOSITION

Counterpoint in the 17th, 18th and 20th centuries (221). The study of harmony after 1850—emphasis on the 20th century (222).

Prerequisite: Music 122 Mr. Huggler

231 (I), 232 (II) ELEMENTS OF MUSIC

A continuation of Music 131-132 with some emphasis on contemporary materials.

2 hours lecture, 1 hour lab

Prerequisite: Music 131-132 or permission of instructor Staff

234 (I) DEVELOPMENT OF CHAMBER MUSIC

Selected works from Haydn to Schonberg, centering chiefly on the medium of string quartet.

Prerequisite: Music 111 or equivalent Mr. Huggler

235 (II) ITALIAN OPERA

Development of opera after the Baroque. Emphasis on Mozart, Verdi, the Verissimo, and Stravinsky's *The Rakes Progress*.

Prerequisite: Music 111 Mr. Prins

241 (I) 19TH CENTURY AMERICAN MUSIC

The growth and development of American music to the year 1900 (Charles Ives) in both its rural-folk and its urban aspects.

Mr. Tawa

242 (II) 20TH CENTURY AMERICAN MUSIC

The present-day ferment in American music, and the gradual emergence of American composers of international stature.

Mr. Tawa

251 (I) HISTORY AND DEVELOPMENT OF JAZZ IN AMERICA

The development of jazz from its origin to the present.

Prerequisite: Music 111 or permission of instructor Mr. Huggler

252 (II) THE HISTORY OF NON-JAZZ BLACK MUSIC

The varieties of Black music found in popular, religious, minstrel show and formal music. Staff

261 (II) 19TH CENTURY MUSIC

The development of symphonic music from Schubert to Mahler.

Prerequisite: Music 111 or equivalent Mr. Tawa

262 (II) MUSIC IN THE 20TH CENTURY

The various directions taken by music since 1900.

Prerequisite: Music 111 Mr. Huggler

271 (I) MUSIC OF THE CLASSICAL PERIOD

Music of the Classical Period with emphasis on Haydn and Mozart.

Prerequisite: Music 111 or equivalent Mr. Tawa

272 (II) THE MUSICAL WORKS OF BEETHOVEN

Beethoven's musical works—his symphonies, quartets, and piano sonatas.

Prerequisite: Music 111 or equivalent Mr. Tawa

291 (I) ORCHESTRATION I

The ranges of instruments, practical ways of combining them and discussion of mass, texture and sound.

1 hour, 3 credits

Prerequisite: Music 294 Staff

293 (I, II) INTRODUCTORY COMPOSITION

Investigations and exercises in rhythmic studies and the relationship of melody to harmony and organic growth.

2 hours, 3 credits

Prerequisite: Theory 121 Mr. Huggler

294 (I, II) INTERMEDIATE COMPOSITION I, II

The beginning of composition in larger forms; phase structure; emphasis on unifying principles in both language and form.

Prerequisite: Music 293 Mr. Huggler

295 (I) MUSIC OF THE HIGH BAROQUE

Music from the time of Bach, Handel, Vivaldi and Couperin.

Prerequisite: Music 111 or equivalent Mr. Tawa

296 (II) ORCHESTRATION II

The ranges of instruments, practical ways of combining them and discussion of mass, texture, and sound.

Prerequisite: Music 293 Mr. Prins

332 (II) MUSIC IN THE RENAISSANCE

The sacred and secular compositions of the 15th and 16th Centuries, from Dufay to Gabrielli.

1 hour, 3 credits

Prerequisite: Music 293

386 METHODS AND PRACTICE TEACHING OF MUSIC IN SECONDARY SCHOOLS

Instruction in methods of teaching music and supervision in practice teaching.

3 hours, 20 hours laboratory (practice teaching), 9 credits

Prerequisite: Admission to Teacher Certification Program Staff

PHILOSOPHY COLLEGE II

ROBERT K. SHOPE, PH.D., Associate Professor of Philosophy and Chairman of Philosophy, College II; GEOFFREY CLIVE, PH.D., Associate Professor of Philosophy; MARTIN ANDIC, PH.D., HOWARD COHEN, PH.D., HOWARD DARMSTADTER, PH.D., Assistant Professor of Philosophy.

GRADUATION REQUIREMENTS

Courses in philosophy are offered at three levels: Introductory, Intermediate, and Advance. Introductory Courses require no prerequisites and are directed to the student body as a whole. Philosophy majors are required to take both Ph 200 (Introduction to Philosophy) and Ph 201 (Introduction to Logic). Ph 200 is required as a prerequisite for any course at the Intermediate level. Intermediate Courses are historical surveys or introductions to special areas of philosophical inquiry which are intended to provide basic knowledge of the field. Advanced Courses are given in the more specialized areas of philosophy.

Summary of requirements for Majors: Ph 200, Ph 201, Ph 211, Ph 212 and five additional courses including at least two from the Advanced Level.

COURSE OFFERINGS

(3 hours, 3 credits each, unless specified)

200 (I, II) INTRODUCTION TO PHILOSOPHY

An introductory examination of the problems and scope of philosophy.

3 hours, 4 credits Staff

201 (I) ANCIENT AND MEDIEVAL PHILOSOPHY

Classical philosophy from Pre-Socratic philosophers through Plato and Aristotle. The central issue of medieval philosophy as represented by the ideas of St. Augustine and St. Thomas Aquinas on reason and revelation, the status of universals, and proofs of God's existence.

3 hours, 4 credits

Prerequisite: One course in Philosophy or permission of instructor

Mr. Cohen

202 (II) MODERN PHILOSOPHY

The views of the Continental Rationalists (Descartes, Spinoza, Leibniz) and the British Empiricists (Locke, Berkeley, Hume) in relation to general intellectual developments from the Renaissance to the Enlightenment.

Prerequisite: Philosophy 200 Staff

204 (II) INTRODUCTION TO LOGIC

The forms of valid reasoning, deductive and inductive, and their role in reflective thinking. The functions of language, informal fallacies, the syllogism, and other types of formal argument; methods of science and modern views of the nature of logic and its relation to other fields.

3 hours, 4 credits Staff

211 ANCIENT PHILOSOPHY

Theories about being and not being, truth and falsehood, meaning and reference, knowledge and belief, reasoning, perception, good and evil from the Pre-Socratics to Aristotle with emphasis on the later dialogues of Plato.

Prerequisite: Philosophy 200 Mr. Andic

216 HISTORY OF ETHICS

(formerly Ph 205)

Critical issues in moral philosophy as exhibited in the writings of Plato, Aristotle, Augustine, Hobbes, Kant, Mill, and Nietzsche.

Prerequisite: Philosophy 200 Staff

220 ETHICAL THEORY

The main problems and theories concerning the nature, scope, and justification of value judgments. A systematic rather than historical approach.

Prerequisite: Philosophy 200 Staff

224 PHILOSOPHY OF ART

Some of the major traditional problems in Aesthetics, such as: the relationship between art and morality, the role of aesthetic experience, and the nature of the imagination and tradition. Considered in classic texts, supplemented by a contemporary survey of critical questions. Mr. Clive

232 (II) 19TH CENTURY RUSSIAN THOUGHT

The major ideologies in 19th century Russian thought as Pan-Slavism, Nihilism, Marxism, and the diverse legacies of German Idealism. The Russian Intelligentsia and the revival of religious thought at the turn of the century; relation to the great tradition of classical Russian Prose fiction.

Prerequisite: Philosophy 200 or permission of instructor Mr. Clive

234 (I) CONTEMPORARY PHILOSOPHY

Some major trends of analytical philosophy in the 20th Century. Emphasis on the role of language in the formulations of and proposed solutions to traditional problems in epistemology and metaphysics.

Prerequisite: Philosophy 200 Mr. Cohen

245 (I) THEORY OF KNOWLEDGE

Knowledge: its nature, forms, methods, scope, and validation.

Prerequisite: Philosophy 200 Staff

246 (II) PHILOSOPHY OF SCIENCE

The nature of scientific explanation; the social and philosophical consequences of scientific achievement.

Prerequisite: Philosophy 200 or permission of instructor Staff

247 (I) PROBLEMS IN METAPHYSICS

In-depth examination of key ideas as they appear in several major metaphysical systems.

Prerequisite: Philosophy 200 or permission of instructor Staff

251 (I) PLATO

The dialogues of Plato; their ethical, metaphysical and epistemological reflections and arguments.

Prerequisite: Philosophy 211 or permission of instructor Staff

260 (I) PHILOSOPHY OF RELIGION

Such traditional issues in the philosophy of religion as arguments for the existence of God, the problem of evil, and the problem of creation and time. Readings supplemented by contemporary approaches.

Prerequisite: Philosophy 200 or permission of instructor Mr. Clive

262 (II) THE CRITICAL PHILOSOPHY OF IMMANUEL KANT

A detailed study of Kant's major work, *The Critique of Pure Reason*, with attention to his epistemology and critique of metaphysics.

Prerequisite: Philosophy 202 or permission of instructor Staff

270 (II) PHILOSOPHY OF MIND

The nature of mind and its relation to body and matter, with emphasis on recent advances in philosophy and psychology.

Prerequisite: Philosophy 200 or permission of instructor Staff

280 (I) SOCIAL AND POLITICAL PHILOSOPHY

An introduction to representative problems and themes of social and political philosophy, especially the concepts of human rights, liberty, justice, equality, law, social obligation, and the social contract.

Prerequisite: Philosophy 200 or permission of instructor Staff

281 (I) PHILOSOPHY OF EDUCATION

Philosophical ideas and concepts relevant to the nature and aims of education.

Staff

291 (I) EXISTENTIALISM

Major forces and concepts in the development of existentialism.

Prerequisite: Philosophy 200 Mr. Clive

300 PHILOSOPHY OF HISTORY

Some special problems concerning the conditions of historical knowledge, such as the possibility of objectivity, the standards for justified explanation, the role of causal laws, and the place of value judgments.

Prerequisite: Any Philosophy course above 200 or permission of instructor Mr. Cohen

352 ARISTOTLE

Aristotle's philosophy as a response to Plato's views about meaning, being, knowledge, ideas, number, and the Good.

Prerequisite: Philosophy 211 or permission of instructor
Mr. Andic

PHYSICAL SCIENCE

386 METHODS AND PRACTICE
TEACHING OF PHYSICAL SCIENCE
IN SECONDARY SCHOOLS

Supervision and critique of Physics and Chemistry teaching in the secondary schools. Examination and evaluation of modern methods, materials and principles of teaching secondary school Physics and Chemistry. 3 hours lecture, 20 hours laboratory (practice teaching), 9 credits

Prerequisite: Admission to Teacher Certification Program and 6 Education credits

Staff

PHYSICS

COLLEGE I

DONALD H. LYONS, PH.D., Professor of Physics and Chairman of Physics, College I; EDWARD S. GINSBERG, PH.D., HAROLD P. MAHON, PH.D., ARTHUR W. MARTIN, PH.D., Associate Professors of Physics; LEONARD A. CATZ, PH.D., NARESHCHANDRA SHAH, PH.D., Assistant Professors of Physics.

COLLEGE II

KENNETH W. FORD, PH.D., Professor of Physics and Chairman of Physics, College II; GEORGE SALZMAN, PH.D., Professor of Physics; MARVIN M. ANTONOFF, PH.D., D.V.G.L.N. RAO, PH.D., JOHN SHANE, PH.D., Associate Professors of Physics; BENJAMIN R. MOLLOW, PH.D., MARTIN POSNER, PH.D., Assistant Professors of Physics; PETER T. FARAGO, M.A., Instructor in Physics.

GRADUATION REQUIREMENTS

Option A is intended primarily for students who plan to pursue graduate studies in a physical science; Option B is intended primarily for students who have broader interests (less physics specialization at the Bachelor degree level), e.g., for those who plan to teach in precollege programs. Election of Option B will not preclude a professional career in physics; however, a somewhat longer period of

graduate study will normally be required than in the case of Option A. Physics majors generally must pass Physics 112 with a grade of C or better for acceptance into the major program.

Option A requires Physics 211, 212, 322, 350, 422, 4 credits of laboratory courses at the level of 281 or higher, of which 2 credits must be taken from 371, 381 or 382, and one elected course selected from those courses numbered 300 or higher; and one semester of an approved mathematics course beyond Mathematics 151. Students interested in this option are advised to begin their mathematics courses and preferably also physics in the freshman year.

Option B requires 32 credit hours in physics courses, including Physics 211, 212, 321, and 4 credits of laboratory courses at the level of 281 or higher, of which 2 credits must be taken from 371, 381 or 382 and Mathematics 150. The student may offer up to 9 credit hours in approved cognate courses in the natural sciences or mathematics in lieu of physics electives.

NOTE: Students who plan graduate work in physics are advised to acquire a facility in reading at least one of the following languages: French, German, or Russian.

COURSE OFFERINGS

(3 hours, 3 credits each, unless specified)

Note: The Department of Physics offers three introductory level physics courses. Physics 101-02 is planned to be comprehensible to all students and is primarily intended for the non-science major. The Department recommends that physical science and mathematics majors enroll in Physics 111-12. Other science majors and students with a strong interest in science are advised to enroll in either Physics 103-04 or 111-12, dependent on their ability to meet the calculus corequisite for the Physics 111-12 sequence.

101 (I), 102 (II) CONCEPTS OF
MODERN PHYSICS

Topics and problems of modern physics, with emphasis on the physical concepts, the

experimental aspects, and their interrelation. Use of the historical approach to illustrate the role of the scientific method in the evolution of physical theories. Discussion of astrophysics, elementary particle physics, nuclear physics and solid state physics. 2 hours lecture, 2 hours recitation, 1 hour laboratory, 4 credits Mr. Ford and Staff

103 (I), 104 (II) COLLEGE PHYSICS

Non-calculus introductory physics for the student with a strong interest or background in science. Topics in mechanics, wave motions, heat, kinetic theory of gases, electricity and magnetism, optics, atomic and nuclear physics.

3 lecture hours, 1 recitation hour, 2½ hours laboratory alternate weeks, 5 credits

Prerequisite: Mathematics 103 or permission of instructor Mr. Posner and Staff

111 (I) FUNDAMENTALS OF PHYSICS I

The fundamental areas of physics covered in an integrated development of classical and modern concepts. Mathematical methods for the solution of problems. Subjects include mechanics, special relativity, thermodynamics, heat, and kinetic theory.

3 hours lecture, 2 hours recitation, 2½ hours laboratory alternate weeks, 5 credits

Prerequisite or corequisite: Mathematics 105 Mr. Shane and Staff

112 (II) FUNDAMENTALS OF PHYSICS II

Electricity, magnetism, and elementary wave motion, including topics in sound and light. Introduction to the quantum nature of light and wave aspects of particles.

3 hours lecture, 2 hours recitation, 2½ hours laboratory alternate weeks, 5 credits

Prerequisite: Physics 111

Prerequisite or corequisite: Mathematics 106 Mr. Shane and Staff

121 (I), 122 (II) INTRODUCTION TO ASTRONOMY

Descriptive introduction to astronomy and astrophysics. Includes study of the planets, stars, galaxies, physics of space exploration and life on other worlds.

3 hours, 4 credits

Prerequisite: 2 semesters of physical science or permission of instructor Mr. Martin

211 (I) INTRODUCTION TO CONTEMPORARY PHYSICS

Wave motion; electromagnetism and light; atomic physics and elements of quantum

mechanics; introduction to elementary particle physics, nuclear physics, and solid state physics.

Prerequisite: Physics 112

Prerequisite or corequisite: Mathematics 150 or permission of instructor Staff

212 (II) MECHANICS

Principles of Newtonian mechanics, conservation laws, gravitational potential theory and conservative fields, central forces, oscillatory systems, rigid body rotation, and relativistic mechanics.

Prerequisite: Physics 211 or permission of instructor; Mathematics 150 Staff

281 (I), 282 (II) PHYSICAL LABORATORY

Basic principles of experimental physics and error analysis. Experiments in mechanics, heat, optics, electricity, magnetism, atomic and nuclear physics.

4 hours laboratory, 2 credits

Prerequisite: Physics 102 or 112, or permission of instructor Mr. Catz

321 (I) THEORY OF ELECTRICITY AND MAGNETISM (I)

Basic concepts of electric magnetic fields: electrostatics, magnetostatics, electric currents, electromagnetism; development of Maxwell's equations and simple applications, physical optics; reflection, dispersion, polarization, and diffraction.

Prerequisite: Mathematics 150

Prerequisite or corequisite: Physics 212 or permission of instructor Mr. Mollow

322 (II) THEORY OF ELECTRICITY AND MAGNETISM (II)

Description of the phenomena of electricity and magnetism in mathematical terms: boundary value problems and boundary conditions, transmission lines, wave guides, radiation from a moving charge; special relativity.

Prerequisite: Physics 321, Mathematics 151 Mr. Mollow

350 (I) STATISTICAL PHYSICS

Topics in heat, thermodynamics, kinetic theory, and elementary statistical mechanics. Prerequisite: Physics 212 or permission of instructor Mr. Shah

361 (I) ELECTRONICS

The fundamentals of electronics, including d.c. and a.c. circuit analysis, vacuum tube

circuits, transistors, amplifiers, oscillators, and pulse and digital circuits.

Prerequisite: Physics 112

Staff

371 (I) BASIC ELECTRONICS WITH LAB

Direct current circuits, electrical measurements, alternating current circuits, circuit analysis, diodes, rectifier circuits, filters, voltage regulators, vacuum tubes, transistors, amplifier circuits, oscillators, comparison measurements, elements of servo systems, operational amplifiers, pulse amplifiers — to be covered in lectures.

1 hour lecture, 4 hours laboratory, 3 credits

Note: Students may not be granted credit for both Physics 361 and 371.

Prerequisite: Physics 112

Mr. Mahon, Mr. Rao

374 (II) SELECTED TOPICS IN ELECTRONICS

Concepts of digital measurements, counting, timing and switching, diode circuits, basic logic concepts, basic theorems in Boolean algebra, manipulation of logic statements, binary information gates, application of logic gates, flip-flops and multivibrators, counters, registers and readout, digital, analog-digital instruments, and systems.

2 lecture hours, 2 credits

Prerequisite: Physics 371

Mr. Rao

381 (I), 382 (II) INTERMEDIATE LABORATORY

Experiments in geometrical and physical optics, electronics, atomic physics, nuclear physics. Individual program of experiments for each student according to his interests and previous experience.

4 hours laboratory, 2 credits

Prerequisite: Physics 281 or 282

Prerequisite or corequisite: Physics 321

In special cases a requirement may be waived with consent of the instructor.

Staff

421 (I) ATOMIC PHYSICS AND INTRODUCTORY QUANTUM MECHANICS

The fundamental and elementary applications of quantum mechanics with emphasis on physical content rather than formalism. Elementary wave mechanics developed and applied to simple atomic structure. Topics include spectroscopic and other phenomena which form the experimental basis of modern atomic physics; the role of the Pauli

principle and spin in determining periodic atomic properties; radiation phenomena.

Prerequisite: Physics 212 or permission of instructor

Mr. Ginsberg

422 (II) NUCLEAR AND PARTICLE PHYSICS

The basic properties of nuclei, particle scattering, radioactivity, nuclear stability, dynamics of nuclear reactions, potential well and barrier problem in quantum mechanics, particles.

Prerequisite: Physics 421

Mr. Ginsberg

430 (II) INTRODUCTION TO SOLID STATE PHYSICS

An introductory treatment of the physics of solids.

Prerequisite: Physics 350 and 421

Mr. Shah

481 (I), 482 (II) ADVANCED LABORATORY

Experimental work in a variety of fields selected to meet the needs of the student.

6 laboratory hours, 3 credits

Prerequisite: Physics 371 or 381 or 382 or permission of instructor

Mr. Mahon

RELATED COURSE:

PHYSICAL SCIENCE 386

METHODS AND PRACTICE

TEACHING OF PHYSICAL SCIENCE

IN SECONDARY SCHOOLS

POLITICS

COLLEGE I

SANFORD LIEBERMAN, PH.D., Assistant Professor of Politics and Chairman of Politics, College I; GLENN TINDER, PH.D., Professor of Politics; RICHARD HOGARTY, PH.D., MAYNARD TOLL, PH.D., Assistant Professors of Politics; ARTHUR SIMONDS, B.A., Instructor in Politics.

COLLEGE II

GEORGE GOODWIN, JR., PH.D., Professor of Politics and Chairman of Politics, College II; PRIMO VANNICELLI, PH.D., Assistant Professor of Politics; RICHARD LANDRY, M.A., DIANE PAUL, M.A., Instructors in Politics; ARNOLD BEICHMAN, M.A., Lecturer in Politics.

GRADUATION REQUIREMENTS

Politics majors are required to take Politics 122 and 123 and eight courses above

the introductory level. At least one upper level course should come from each of these four fields: American Government and Politics, Comparative Government and Politics, International Relations, Political Theory. With the approval of a student's adviser, cognate courses may be substituted for two of the eight upper-class Politics courses. Majors with a cumulative average of at least 3.0 may, with the approval of the Department, write a senior thesis. They should register for Politics 393, 394.

COURSE OFFERINGS

(3 hours, 3 credits each, unless specified)

122 (II) GOVERNMENT AND POLITICS OF THE UNITED STATES

The three main branches of the national government, federalism, political parties and interest groups, and governmental functions. 3 hours, 4 credits

Staff

123 (I, II) POLITICAL IDEAS OF THE 20TH CENTURY

Major political viewpoints of the present, including conservatism, liberalism, Marxism and Fascism.

3 hours, 4 credits

Staff

201 (I) POLITICAL PARTIES

The American political process, with emphasis on political parties, pressure groups and public opinion.

Prerequisite: Junior standing

Mr. Goodwin

205 (I, II) THE AFRO-AMERICAN EXPERIENCE: THE POLITICS OF PROTEST

An historical study of Black Africa with special reference to the political dimension of the Afro-American heritage.

Prerequisite: Junior standing

Staff

212 (II) THE LEGISLATIVE PROCESS

The functions of national and state legislatures, and the role played by political parties and interest groups in the legislative process.

Prerequisite: Junior standing

Mr. Goodwin

223 (I) PUBLIC ADMINISTRATION

The bureaucratic process, emphasizing organizational behavior, changes in administrative institutions and theories, and the political role of bureaucracy.

Prerequisite: Junior standing

Mr. Hogarty

231 (I) AMERICAN CONSTITUTIONAL LAW AND THEORY

The development of the United States Constitution, chiefly through decisions of the Supreme Court. Emphasis on the origin and nature of judicial powers, the way it inhibits and facilitates operation of the political process, and the search for standards by which to judge the judges.

Prerequisite: Junior standing

Staff

241 (I) METROPOLITAN POLITICS

Municipal politics, organization and functions; special reference to impact of recent social and economic changes upon city, suburban and intergovernmental politics in metropolitan regions.

Prerequisite: Junior standing

Miss Paul

242 (I) PROBLEMS OF URBAN POLITICS

Some of the philosophical issues raised by urbanization: Are cities necessary? Is the relatively democratic structure of American cities responsible for some of their problems? Has there been a "revolution of rising expectations" in urban life? Considered in historical and comparative perspectives.

Prerequisite: Junior standing

Miss Paul

244 (II) THE FEDERAL SYSTEM

Consequences of areal division of power for politics at national, state and local levels.

Prerequisite: Junior standing

Staff

245 (II) STATE AND LOCAL POLITICS

The dynamics and interrelationships of state and local governmental units, emphasizing leadership resources and political change.

Prerequisite: Junior standing

Mr. Hogarty

251 (I), 252 (II) EUROPEAN COMPARATIVE GOVERNMENT

Problems in the government and politics of selected European countries.

Prerequisite: Junior standing

Mr. Simonds

253 (II) GOVERNMENT AND POLITICS OF BRITAIN

Political institutions as they exist in the land of 'ultrastability,' social accommodation and circulatory elitism. Comparisons with institutions in other Western democracies.

Prerequisite: Junior standing

Mr. Beichman

254 (II) GOVERNMENT AND POLITICS OF THE SOVIET UNION

The historical and ideological origins of the

Soviet Union; the role and beliefs of the Communist party under Lenin and Stalin and in the post-Stalin period; contemporary Soviet ideology and Western theories of totalitarianism.

Prerequisite: Junior standing

Mr. Lieberman

257 (I), 258 (II) GOVERNMENT AND POLITICS OF AFRICA

African government and politics with emphasis on stability in African political systems and on the role of tribes, political parties, armies, and government bureaucracies.

Prerequisite: Junior standing Mr. Nketsia

261 (I) THE POLITICS OF NATIONAL DEVELOPMENT

The extent to which elements of the 'third world' have progressed from statehood to nationhood during the quarter century following the great anticolonial revolution.

Prerequisite: Junior standing

Mr. Beichman

264 (II) CHINA IN THE MODERN WORLD

The attempts of three Chinese regimes — the Traditional, the Nationalist, and the Communist — to cope with the domestic and international problems created by China's emergence as a nation-state.

Prerequisite: Junior standing Mr. Landry

301 (I) INTERNATIONAL RELATIONS

The nation-state system and conceptions of national interest in modern world politics; forms and distribution of power; the making of foreign policy and adjusting international conflict.

Prerequisite: Junior standing Mr. Toll

304 (II) AMERICAN FOREIGN POLICY

Major issues and problems of American foreign policy in the contemporary world.

Prerequisite: Junior standing Mr. Toll

306 (II) SOVIET UNION POLICY

The foreign policy of the Soviet Union. Topics include: continuity and change; the role of ideology and national interest; the origin and dynamics of the Cold War; the Sino-Soviet dispute; and Soviet-East European relations.

Prerequisite: Junior standing

Mr. Lieberman

351 (I) ANCIENT AND MEDIEVAL POLITICAL THOUGHT

The origins and the early development of the main political ideas of the West.

Prerequisite: Junior standing Mr. Tinder

352 (II) MODERN POLITICAL THOUGHT

The history of Western political ideas from the time of Machiavelli to that of Marx.

Prerequisite: Junior standing Mr. Tinder

356 (II) AMERICAN POLITICAL THOUGHT

An analytical and historical study of the development of American political thought and institutions from colonial times. Primary source readings feature the ideas and deeds of those who have shaped the American concept of free government.

Prerequisite: Junior standing Staff

362 (II) SOCIALISM IN THE MODERN WORLD

The origins and doctrines of modern socialism with particular emphasis on Marxist-Leninist thought. Topics include: Utopian and Guild Socialism, Fabianism, Syndicalism, Titoism, Marxist Revisionism, Maoism, and Socialism in the United States.

Prerequisite: Junior standing

Mr. Lieberman

371 (I) HISTORY OF CHINESE POLITICAL THOUGHT

The origins and continuity of Chinese political thought and its radical transformation in the 20th century.

Prerequisite: Junior standing Mr. Landry

391 (I), 392 (II) SEMINAR

Intensive studies in various important fields in politics. Emphasis on independent research.

By invitation of department Staff

393 (I), 394 (II) SPECIAL PROBLEMS

Guided reading in special areas of Politics. May be used for Honors thesis.

By invitation of department Staff

395 (I), 396 (II) SPECIAL PROBLEMS IN THE FIELD OF POLITICS

Seminar in the field of practical politics generally taught by professional politicians.

By invitation of department Staff

RELATED COURSES:

Social Sciences 131 (I) Introduction to Social and Political Analysis

Social Sciences 226 (II) The Politics and Sociology of Ecology
Social Sciences 300 (I, II) Communications and Opinion

PSYCHOLOGY

COLLEGE I

DONALD KRUS, PH.D., Professor of Psychology and Acting Chairman of Psychology, College I; BERNARD ROSENBLATT, PH.D., Professor of Psychology; SEBASTIANO SANTOSTEPHANO, PH.D., Part-time Professor of Psychology; PETER COMALLI, PH.D., Visiting Associate Professor of Psychology; INA SAMUELS, PH.D., Part-time Associate Professor of Psychology; GERALD BAROFSKY, PH.D., WILLIAM BERKOWITZ, PH.D., ROBERT BROOKS, PH.D., SUSAN GASSNER, PH.D., EMMA G. KRAIDMAN, PH.D., HARRY LEWIS, M.A., CELIA MOORE, PH.D., BARBARA ROSS, PH.D., JONATHAN SLAVIN, PH.D., Assistant Professors of Psychology; SUSAN MONJAN, PH.D., Part-time Assistant Professor of Psychology.

COLLEGE II

THOMAS KREILKAMP, PH.D., Assistant Professor of Psychology, Acting Chairman of Psychology, College II; MAXWELL J. SCHLEIFER, PH.D., Professor of Psychology; SANFORD AUTOR, PH.D., STANLEY KLEIN, PH.D., Associate Professors of Psychology; NELSON BUTTERS, PH.D., Part-time Associate Professor of Psychology; GRACE BARUCH, PH.D., PAUL KANZER, PH.D., Assistant Professor of Psychology; ARTHUR MCCAFFREY, PH.D., ETHAN POLLACK, PH.D., SUELLEN RUBIN, PH.D., Part-time Assistant Professors of Psychology; DAVID EDELSTEIN, M.A., Instructor in Psychology; PETER COMBOSI, PH.D., Part-time Instructor in Psychology; GEORGE GARDNER, PH.D., Visiting Lecturer in Psychology.

GRADUATION REQUIREMENTS

Psychology majors must take Psychology 122 plus eight advanced courses. Majors who intend to apply to graduate departments of Psychology are strongly advised to take Psychology 235 and 271.

Students who wish to take an advanced course before their junior year must have permission of the instructor.

COURSE OFFERINGS

(3 hours, 3 credits each, unless specified)

122 (I, II) INTRODUCTION TO PSYCHOLOGY: PSYCHOANALYSIS AND THE STUDY OF MAN

Basic psychoanalytic concepts applied to the study of man.

3 hours, 4 credits

Prerequisite: Sophomore standing Staff

235 (I, II) SYSTEMS OF PSYCHOLOGY

Major trends in contemporary psychology, based on historical evaluation of the leading concepts.

Prerequisite: Junior standing Mr. Schleifer

237 (I, II) DEVELOPMENTAL PSYCHOLOGY

Normal and abnormal development of mind and personality, with special emphasis on infancy, childhood, and adolescence.

Prerequisite: Junior standing Mr. Klein

238 (I) ADVANCED DEVELOPMENTAL PSYCHOLOGY: SPECIAL TOPICS IN DEVELOPMENTAL PSYCHOLOGY

The theoretical frontiers in clinical child psychology, from a developmental approach.

Prerequisite: Permission of instructor Staff

239 (I, II) EDUCATIONAL PSYCHOLOGY

Application of psychological concepts to education with emphasis on the role of the school, the family, the classroom, and the teacher in the educational process.

Prerequisite: Junior standing Staff

240 (I, II) PSYCHOPATHOLOGY

Etiology, dynamics and treatment of psychopathology.

Prerequisite: Junior standing Staff

241 FREUD'S CASE HISTORIES

Careful review of Freud's published case histories: Dora, The Rat Man, The Wolf Man, Schreber, Little Hans. Special attention to the problems of the case history as scientific evidence. Some relationships between the writing of case histories and the writing of fiction and biography.

Prerequisite: Psychology 122, Psychology 237, Psychology 240, Psychology 260 Staff

250 (I, II) THEORIES AND FUNDAMENTAL ISSUES OF LEARNING

Review of such basic learning theories as those of Pavlov, Hull, Tolman, and Kohlet, and an attempt to apply theory to selected topics.

Prerequisite: Junior standing Staff

260 (I, II) THEORIES OF PERSONALITY

A comprehensive history and study of major personality theories.

Prerequisite: Junior standing Mr. Schleifer

270 (I, II) SOCIAL PSYCHOLOGY

A basic survey of social psychology, with focus on the nature of human groups and the way man's participation in them affects his own behavior.

Prerequisite: Psychology 122 and Junior standing Staff

271 (I, II) EXPERIMENTAL METHOD IN PSYCHOLOGY

The historical foundations and development of psychology as a science with focus on the nature of scientific method in general, and experimental method in particular.

Prerequisite: Psychology 122; majors only or permission of instructor Staff

272 (I, II) PSYCHOLOGY OF PERCEPTION

The traditional problems of perception, with focus on the changing theoretical perspectives within which these problems are viewed. Evolution in theory from early elementalistic approaches to the more current concern with perception-personality relationships.

Prerequisite: Psychology 122 and Junior standing Mr. Krus

273 (I, II) PHYSIOLOGICAL PSYCHOLOGY

A basic survey of physiological psychology: sensory processes, motor behavior, drives and instincts, arousal, and learning.

Prerequisite: Psychology 122 Mr. Weiss

275 (I, II) THINKING AND DISORDERS OF THOUGHT

The nature of the thought process; theories of thinking; contributions of psychopathology to an understanding of thinking.

Prerequisite: Psychology 122 and Junior standing Staff

277 (I, II) COMPARATIVE PSYCHOLOGY

Evolution of behavior, similarities and differ-

ences in capacities for environmental adjustment and for behavioral organization among the important types of living beings, from plants and unicellular organisms to the primates, including man.

Staff

280 (I, II) HISTORY OF PSYCHOLOGY

Psychological concepts from Aristotle to Freud; a consideration of the classic doctrines of man, the views of the 17th century philosophers, the Darwinian influence and a preview of 20th century developments.

Staff

295 (I), 296 (II) PROBLEMS IN PSYCHOLOGY

Independent work on special problems or in certain fields of psychological interest by arrangement with department.

Staff

297 NORMALITY AND PSYCHOPATHOLOGY IN CHILDHOOD

An advanced course in developmental psychology and psychopathology. Deals mainly with early childhood and emphasizes Anna Freud's views as they have evolved from experience in the psychoanalysis of children. Specific topics include: temporary regression in childhood; the transitional object; consciousness in childhood; the influence of physical illness and hospitalization on mental development; object loss; the diagnostic profile; the concept of developmental lines; the concept of the representational world. Prerequisite: Psychology 122, Psychology 237, Psychology 240, Psychology 260

298 SCIENTIFIC METHOD AND STATISTICAL ANALYSIS

Scientific method as it applies to psychology, and the role of statistics within that method. Fundamental statistical concepts and techniques; primary stress on the logic which underlies their use as descriptive and analytic tools in psychological inquiry.

Prerequisite: Math 101 and 102 or equivalent Staff

299 THE FAMILY AND CHILD: A PSYCHOLOGICAL VIEW

The role of the family in psychological development of the child. A psychodynamic view of the family, to examine stages of development from the third trimester of pregnancy to sixteen years of age.

Staff

RUSSIAN COLLEGE II

GEORGE SIEGEL, PH.D., Associate Professor of Russian and Chairman of Russian, College II; GEORGE N. KOSTICH, M.A., ANNY NEWMAN, M.A., Instructors in Russian.

GRADUATION REQUIREMENTS

1. Seven courses in the department beyond the intermediate level which must include Russian 231-232 (3rd year Russian), Russian 221-222 (Russian Literature in Translation), and either Russian 241 (Russian Phonetics) or Russian 242 (Structure of the Russian Language).
2. Russian History, History 235-236.
3. One semester course of literature in the original.

COURSE OFFERINGS

(3 class hours, 3 credits each, unless specified)

Course numbers 221, 222, 355 and 356 are literature courses in translation. They satisfy the language requirement. All other courses are given in Russian.

111 (I), 112 (II) ELEMENTARY RUSSIAN

For students with no previous training in Russian. Development of the four language skills, based on an audio-lingual approach.
4 hours, 2 hours laboratory
4 credits

Staff

121 (I), 122 (II) INTERMEDIATE RUSSIAN

Intensive review of grammar. Continued practice in speaking, writing and listening.
4 hours, 4 credits
Prerequisite: Russian 122 or equivalent

Staff

221 (I), 222 (II) RUSSIAN LITERATURE IN TRANSLATION

Modern Russian literature, concentrating on prose, from 1800 to the present. No reading knowledge of Russian required.
Prerequisite: Sophomore standing
3 hours, 4 credits

Mr. Siegel

231 (I), 232 (II) INTRODUCTION TO RUSSIAN LITERATURE

Reading of selected classics of 19th and 20th

century Russian literature, combined with written and oral work.

Prerequisite: Russian 122 or equivalent

Mrs. Newman

241 (II) THE SOUND PATTERNS OF RUSSIAN

Detailed analysis of the sound system, articulation and intonational patterns of the Russian language. Emphasis on aural comprehension and oral fluency.

Prerequisite: Russian 122 or equivalent

Mrs. Newman

242 STRUCTURE OF THE RUSSIAN LANGUAGE

The structure of the contemporary Russian language. Morphology, accentology and syntax.

Prerequisite: Russian 122 or equivalent

Mrs. Newman

331 (I), 332 (II) RUSSIAN STYLISTICS

The style of Russian literary works. Practical application of principles of grammar and intensive study of idiomatic expressions.

Prerequisite: Russian 232 or equivalent

Mr. Kostich

357 (I) 19TH CENTURY RUSSIAN POETRY

Readings in Lermontov, Tjutchev, and Nekrasov.

Prerequisite: Russian 122 (or 2 years of Russian)

Mr. Siegel

358 (II) PUSHKIN

Readings in the poetry and prose of Pushkin.

Prerequisite: Russian 122 (or 2 years of Russian)

Mr. Siegel

359 (I) 20TH CENTURY RUSSIAN POETRY

Close reading and analysis of the Russian texts of poems of Mayakovsky, Voznesensky, and Evtushenko.

Prerequisite: Sophomore standing

Staff

386 METHODS AND PRACTICE TEACHING OF RUSSIAN IN SECONDARY SCHOOLS

The issues, principles and methods of secondary school Russian language teaching. Supervision and critique of practice teaching.

3 hours, 20 hours laboratory (practice teaching), 9 credits

Prerequisite: 6 hours Education courses and admission to Teacher Certification Program

Mrs. Newman

**RUSSIAN LITERATURE IN
TRANSLATION**

**263 (II) RUSSIAN CULTURE AND
CIVILIZATION**

Aspects of Russian history, religion, literature, art, architecture, and music studied in relation to one another rather than in isolation. Within the general framework, students are encouraged to pursue topics of individual interest.
3 hours, 4 credits
Prerequisite: Sophomore standing Staff

**264 (I) BULGAKOV, PASTERNAK
AND SOLZHENITSYN**

Readings in English translation of selected novels and short stories of three major Soviet writers.
3 hours, 4 credits
Prerequisite: Sophomore standing Staff

265 (I) CHEKHOV

Readings of selected plays and short stories of Chekhov in English translation.
3 hours, 4 credits
Prerequisite: Sophomore standing Staff

353 (I) DOSTOEVSKY

Historical and literary background. No reading knowledge of Russian required. Russian majors expected to do a part of the reading in the original.
3 hours, 4 credits
Prerequisite: Sophomore standing Staff

354 (II) TOLSTOY

Historical and literary background. No reading knowledge of Russian required. Russian majors expected to do a part of the reading in the original.
3 hours, 4 credits
Prerequisite: Sophomore standing Mr. Kostich

355 (II) SOVIET LITERATURE

Beginnings and development of Soviet prose, drama and criticism from Gorky to the present. No reading knowledge of Russian required. Majors required to do research in Russian.
3 hours, 4 credits Staff

356 (I) RUSSIAN DRAMA

The masterpieces of the Russian theatre from the beginnings to recent years. Plays from Fonvizin to Gorky. No reading knowledge of Russian required. Russian majors

expected to do a part of the reading in the original.
3 hours, 4 credits
Prerequisite: Sophomore standing
Mr. Kostich

SOCIAL SCIENCES

COURSE OFFERINGS

(3 class hours, 3 credits each unless specified)

**131 (I) INTRODUCTION TO SOCIAL
AND POLITICAL ANALYSIS**

Political processes as general phenomena, occurring in all social and political institutions, seen through ideas derived from the study of political behavior, organization theory, and political anthropology, and evaluated in terms of normative political philosophy. Recommended for students with specific vocational goals or background in organizational activity.
3 hours, 4 credits Staff

**211 (I), 212 (II) BOOKS AND THE
CITY CHILD**

Children's literature as a reflection of the world of the city child and its use in expanding that world.
Mrs. Brown, Mrs. Kaufman

**226 (II) THE POLITICS AND
SOCIOLOGY OF ECOLOGY**

Sociological and political perspectives on the relationship between man and his environment. Special attention to Boston.
Prerequisite: Junior standing Staff

**300 (I, II) COMMUNICATIONS AND
OPINION**

Sociological and political perspectives on mass communications.
Prerequisite: Junior standing Staff

**386 (I, II) METHODS AND PRACTICE
TEACHING OF SOCIAL STUDIES IN
SECONDARY SCHOOLS**

The issues, principles, and methods of secondary school social science teaching; supervision and critique of practice teaching.
3 hours, 20 hours laboratory (practice teaching), 9 credits
Prerequisite: 6 hours Education courses and admission to Teacher Certification Program
Mrs. Mark

SOCIOLOGY

COLLEGE I

JAMES E. BLACKWELL, PH.D., Professor of Sociology and Chairman of Sociology, College I; NANA KOBENA NKETSIA, D. Phil., Visiting Professor of Politics and Sociology; RICHARD ROBBINS, PH.D., DAISY TAGLIACOZZO, PH.D., Professors of Sociology; JOHN DICKINSON, PH.D., CALVIN LARSON, PH.D., Associate Professors of Sociology; GERALD GARRETT, PH.D., LENORA GREENBAUM, PH.D., SIAMAK MOVAHEDI, PH.D., Assistant Professors of Sociology.

COLLEGE II

PEGGY MARQUIS, PH.D., Assistant Professor of Sociology and Chairman of Sociology, College II; GORDON ZAHN, PH.D., Professor of Sociology; JEANNE BINSTOCK, PH.D., HARRY BRILL, PH.D., Assistant Professors of Sociology; HARRY FINKELSTEIN, M.S.W., HOWARD ROTBLAT, M.A., SHARON STICHTER, B.A., Instructors in Sociology; LAWRENCE KAMARA, M.A., Part-time Lecturer in Sociology.

GRADUATION REQUIREMENTS

The Department of Sociology and Anthropology offers a major in Sociology as well as a concentration in Anthropology for a limited number of students. Majors should take introductory courses in Psychology and Sociology during the Sophomore year and a minimum of eight additional courses in the Junior and Senior years. Within the major, the Department requires one course in Anthropology, Sociology 356, and Sociology 382 (to be taken during the Senior year). At the invitation of the Department, a Senior may take individual directed study with an emphasis on independent research. Majors are encouraged to choose related subjects within the Division of Social Sciences. The Department permits up to two cognate courses from other social sciences to be counted toward the major. A list of these courses can be consulted at the Departmental Office.

Students interested in a career in

Corrections and related fields are advised to take Sociology 274, 309, 310, and 312.

COURSE OFFERINGS

(3 hours, 3 credits each, unless specified)

121 (I, II) INTRODUCTION TO SOCIOLOGY

The structure of society, cultural patterns, and group life. The individual and socialization, groups, institutions, social systems, social change.

3 hours, 4 credits

Staff

200 HUMAN SERVICE ORGANIZATIONS

Theory and practice of people-processing and people-changing organizations.

Prerequisite: Sociology 121

Mr. Finkelstein

221 (II) THE URBAN COMMUNITY

The development of the city as a complex form of the human community. History and growth of urbanism in industrial societies and developing nations. Urban change and the problem of planning.

Prerequisite: Sociology 121

Mr. Finkelstein, Mr. Larson, Mr. Brill

226 POLITICS AND SOCIOLOGY OF ECOLOGY

Political processes as general phenomena occurring in all social and political institutions, considered through ideas derived from the study of political behavior, organization theory and political anthropology, and evaluated in terms of normative political philosophy.

3 hours, 4 credits

Staff

242 FAMILY

A comparative and historical analysis of family systems. Emphasis on the development and future prospects of the nuclear family in middle-class industrial society.

Prerequisite: Sociology 121

Mr. Dickinson, Mr. Kamara

252 (I) RACIAL AND ETHNIC RELATIONS

Conflicts and accommodations among differing racial and ethnic groups. Nature and character of prejudice and discrimination. Minority-Majority relations in selected societies.

Prerequisite: Sociology 121

Mr. Blackwell, Mr. Robbins

- 253 (II) POPULATION AND ECOLOGY**
The population explosion, birth, death, and illness. Immigration and emigration. How the human and physical environment interacts with features of population.
Prerequisite: Sociology 121 Mr. Dickinson
- 262 (II) POLITICAL SOCIOLOGY**
An interdisciplinary study with stress on the nature of power and its distribution in society. Alternative approaches to changing and transforming power structures.
Prerequisite: Sociology 121 and Politics 121
Mr. Rotblat, Mrs. Stichter
- 274 (I) SOCIAL DEVIANCE AND CONTROL**
The social conditions of individual and group behavior disorders; deviant subcultures and social control.
Prerequisite: Sociology 121
Mrs. Marquis, Mr. Garrett
- 275 (I) SOCIETY AND THE INDIVIDUAL**
Basic survey of the impact of social environment on the behavior, attitudes and personality of individuals. Theoretical and research literature bearing on the concept of socialization as a continuous process through the life cycle, with emphasis on the implications for personal and social change.
Prerequisite: Sociology 121 and Psychology 122
Mrs. Marquis
- 276 SOCIAL PSYCHOLOGY OF SEX ROLES: MEN AND WOMEN IN SOCIETY**
An analysis of male and female roles in society with consideration of biological and psychological factors. Attention to socialization processes which reflect societies' functional definition of acceptable and deviant sex roles.
Prerequisite: Sociology 121
Mrs. Marquis
- 300 COMMUNICATIONS AND OPINION**
Sociological and political perspectives on mass communications.
Prerequisite: Sociology 121 and Junior standing
Staff
- 309 (I, II) JUVENILE DELINQUENCY**
The nature and extent of delinquency, explaining theories, delinquent subculture, and programs for control and prevention.
Prerequisite: Junior standing and Sociology 121
Mr. Blackwell, Mr. Garrett
- 310 (I, II) CRIMINOLOGY**
A general survey and analysis of adult crime. Attention to historical development of criminological thought, societal reaction to crime and behavioral systems. Emphasis on theories of criminality and issues in the administration of justice by police and courts.
Prerequisite: Sociology 121 and Junior standing
Mr. Blackwell, Mr. Garrett
- 312 (I, II) CORRECTIONS**
Prisons, jails, parole, and probation. Attention to inmate social structure, philosophy underlying correctional system and modern treatment approaches.
Prerequisite: Junior standing and Sociology 309
Mr. Garrett
- 316 MODERNIZATION**
Social and economic aspects of development and modernization in various societies.
Prerequisite: Sociology 121 and/or Anthropology 122
Staff
- 317 IDEOLOGY AND SOCIAL CONTROL IN SOUTHERN AFRICA AND LATIN AMERICA**
From a comparative perspective, the exercise and structure of power in selected nations, states of Latin America and Southern Africa. Special reference to race and social class.
Prerequisite: Sociology 121, Anthropology 122 or Politics 122
Staff
- 318 THEORY OF SOCIAL CHANGE**
Alternative theories of social change, at the societal and community levels. Classical theories of change, including Durkheim, Weber, and Marx, and contemporary theories. Selected applications.
Prerequisite: Sociology 316 or Sociology 121 and permission of instructor
Staff
- 327 (I) SOCIAL STRATIFICATION**
Social classes in traditional and industrial societies, classes, castes, and mobility. Theories of class relationships and conflicts.
Prerequisite: Sociology 121 and Psychology 122
Mrs. Binstock
- 338 (I, II) SOCIOLOGY OF EDUCATION**
The educational systems of various types of western and non-western societies and the changes in Western systems in modern history, with particular reference to the U.S. The structural features of types of American

schools and colleges and the relevance of these features to the economy and the ideology.

Prerequisite: Sociology 121

Mr. Robbins, Mrs. Binstock

339 SOCIOLOGY OF RELIGION

Belief systems and social structures of religious groups. Impact of religious systems on familial, economic, political, and other institutions.

Prerequisite: Permission of instructor

Mr. Zahn

345 COLLECTIVE BEHAVIOR

The nature and form of religious, ethnic, racial and other types of groupings, mass society and masses in society; formation and structure of crowds.

Prerequisite: Sociology 121 or Anthropology 122

Staff

354 ELEMENTS OF SOCIAL STATISTICS

Fundamentals of social statistics; special emphasis on probability, tests of significance, and measures of association.

Prerequisite: Sociology 121 and 6 hours of Soc-Anthro; Junior standing or permission of instructor

This course is not a prerequisite for So 356 for sociology majors in College II

Mr. Movahedi

355 COMPARATIVE SOCIAL STRUCTURES

The comparative study of large-scale social systems with emphasis on national societies. The theory and methodology of comparison and comparisons of major features of social systems. Construction of typologies.

Prerequisite: Sociology 121 and Junior standing

Mrs. Stichter, Staff

356 (I, II) METHODS OF SOCIOLOGICAL RESEARCH

Design of sociological research and methods of inquiry. Organization and analysis of data. Development of research projects.

Prerequisite: Sociology 121 and 354 (College I sociology majors) and Junior standing

Mr. Garrett, Mr. Movahedi, Mr. Rotblat

357 (I, II) FIELD WORK METHODS

Intensive training in observational methods; readings of theoretical issues involved; concentrated community oriented field work under close supervision.

Prerequisite: Sociology 121 or Anthropology 122

Staff

382 (I, II) ELEMENTS OF SOCIOLOGICAL THEORY

Reading and discussion of basic sociological works in theory. Relevance of earlier and contemporary theory to contemporary sociological interests and research.

Prerequisite: Sociology 121 and Junior standing

Mr. Larson, Mr. Robbins, Mr. Zahn

389 (I, II) SPECIAL TOPICS SEMINAR

Intensive study of special topics varying each year according to instructor.

Prerequisite: Sociology 121 and permission of instructor

Staff

399 (I, II) DIRECTED STUDY IN SOCIOLOGY

Students invited by the Department to conduct independent research during the Senior year. Periodic consultation and guidance provided by the staff.

Hours by appointment; 3 credits

Prerequisite: Sociology 121 and Psychology 122

Staff

502 (I, II) SOCIOLOGY OF SOCIAL MOVEMENTS

Analysis of general characteristics of social movements as a vehicle of social change — with focus on selected historical social movements.

Prerequisite: Sociology 121, Senior or Graduate standing

Mr. Zahn

510 (I, II) THE SOCIOLOGY AND PSYCHOLOGY OF COMPLEX ORGANIZATIONS

Types of organizational structures both historically and in industrial societies. Profit-making and non-profit-making organizations, such as schools, business and public bureaucracies, corporations, churches, hospitals, and prisons.

Prerequisite: Sociology 121 and Senior or Graduate standing

Staff

SPANISH

COLLEGE I

RICARDO NAVAS-RUIZ, PH.D., Professor of Spanish and Chairman of Spanish, College I; L. RICARDO ALONSO, Doctor en Ciencias Sociales y Derecho Público; NELLIE SÁNCHEZ-ARCE, PH.D., Associate Professors of Spanish; ADORNA WALIA,

PH.D., Assistant Professor of Spanish; IVONNE BUCK, Ed.M., CHAD WRIGHT, M.A., Instructors in Spanish.

COLLEGE II

JAMES RYAN, Ph.D., Professor of Spanish and Chairman of Spanish, College II; MARIA C. ZARDOYA, Ph.D., Professor of Spanish; MARIA-LUISA OSORIO, Doctor en Filosofía y Letras, Assistant Professor of Spanish; JOSÉ DE JESUS BARBA-MARTIN, M.A., HILTON HALL, M.A.T., MARIA-LUISA ROBERTS, Pasante, Instructors in Spanish.

GRADUATION REQUIREMENTS

Spanish majors are required to take Spanish 311, 312, and at least eight additional semesters of advanced courses, including two semesters of Spanish-American Literature and one semester of Cervantes (Spanish 336). Majors are strongly advised to take Advanced Spanish Grammar and Composition and Conversation before taking advanced literature courses.

Majors who plan to go on for a higher degree in Spanish are advised to take two semesters of Golden Age Literature, with at least one semester in the Comedia (drama).

Students may receive 3 credits toward their total of 24 major credits for acceptable work on an Honors Thesis written under the direction of an adviser from the Spanish faculty.

COURSE OFFERINGS

(3 hours, 3 credits each, unless specified)
Courses 131-132, 261 and 262 are literature courses in translation. They satisfy the language requirement. All other courses are given in Spanish.

111 (I), 112 (II) ELEMENTARY SPANISH

For students with no creditable training in Spanish. An intensive study of the four language skills based on an audio-lingual approach.

4 hours, 1 hour laboratory, 4 credits Staff

121 (I), 122 (II) INTERMEDIATE SPANISH

An oral review and further study of the lan-

guage skills with readings in Spanish and Spanish-American literature and culture.

4 hours, 4 credits

Prerequisite: Spanish 112 or equivalent Staff

131 (I), 132 (II) INTRODUCTION TO HISPANIC LITERATURE IN TRANSLATION

Introduction to the student to the best in modern literature from Spain and Spanish-America. Instructors make selections from writers such as Asturias, Borges, Cela, Fuentes, Galdós, García-Lorca, García-Marquez, Goytisolo, Mallea, Matute, Ortega, Paz, Unamuno, Vargas-Llosa, and others. Knowledge of Spanish not required.

3 hours, 4 credits Staff

231 (I) INTRODUCTION TO SPANISH CULTURE

Selected readings in the literature and culture of the Hispanic world. Oral reports and papers based on the readings.

Prerequisite: Spanish 122 or equivalent Miss Sánchez-Arce

232 (II) INTRODUCTION TO SPANISH-AMERICAN CULTURE

Selected readings in the literature and culture of the Spanish-American world. Oral reports and papers based on the readings.

Prerequisite: Spanish 122 or equivalent Mrs. Osorio

261 (I) SPANISH MASTERPIECES IN TRANSLATION

Outstanding works of Spanish literature from the Middle Ages through the Renaissance and the Golden Age to modern times. No knowledge of Spanish required. Not open to Spanish majors.

3 hours, 4 credits
Prerequisite: 1 soph. Eng. course or permission of instructor Mr. Ryan

262 (II) MODERN SPANISH-AMERICAN LITERATURE IN TRANSLATION

Works of some of the outstanding Spanish-American writers of the 20th century. No knowledge of Spanish required.

3 hours, 4 credits
Prerequisite: 1 soph. Eng. course or permission of instructor Mrs. Walia

301 (I) ADVANCED SPANISH GRAMMAR

An intensive study of Spanish grammar and

syntax; emphasis on written exercises, themes, and papers.

Prerequisite: Spanish 122 or equivalent
Mr. Hall

302 (II) SPANISH COMPOSITION AND CONVERSATION

Intensive work in written and oral Spanish: weekly themes and frequent oral reports and speeches. Although Advanced Spanish Grammar is not a prerequisite, 302 is planned as a continuation of Spanish 301.

Prerequisite: Spanish 122 or equivalent
Miss Sánchez-Arce

311 (I), 312 SURVEY OF SPANISH LITERATURE

Intensive reading of masterpieces of Spanish literature. Written and oral reports required.

Prerequisite: Spanish 122 or equivalent, and permission or instructor
Mrs. Osorio

321 (II) SPANISH CIVILIZATION

Studies in Spanish history, art, architecture, and music as a background for literature; readings, discussions, papers.

Prerequisite: Spanish 122 or equivalent
Miss Sánchez-Arce

322 (II) SPANISH-AMERICAN CIVILIZATION

Major aspects of the cultural evolution of the Spanish-American countries from pre-Hispanic days to the present.

Prerequisite: Spanish 122 or equivalent
Staff

331 (I) POETRY OF THE GOLDEN AGE

Selections from Garcilaso, Herrera, Fray Luis de León, San Juan de la Cruz, Lope de Vega, Góngora, Quevedo.

Prerequisite: Spanish 312
Miss Zardoya

332 (I) GOLDEN AGE PROSE

Selections from various forms of Spanish prose such as pastoral and Moorish novel, moral, mystical, and satiric prose.

Prerequisite: Spanish 312
Miss Sánchez-Arce

333 (I), 334 (II) GOLDEN AGE THEATER

Outstanding dramatists of the 16th and 17th centuries: Torres Naharro, Gil Vicente, Lope de Rueda, Juan de la Cueva, Cervantes, Lope de Vega, Guillén de Castro, Mira de Amescua, Tirso de Molina, Ruiz de Alarcón,

Calderón de la Barca, Rojas Zorrilla, Moreto, and others.

Prerequisite: Spanish 312
Staff

335 (I) CERVANTES

The works of Cervantes with the exclusion of *Don Quixote*.

Prerequisite: Spanish 312
Miss Zardoya

336 (II) CERVANTES

An analytical study of *Don Quixote*.

Prerequisite: Spanish 312
Miss Zardoya

337 (II) THE PICARESQUE NOVEL

The major picaresque novels of the 16th and 17th centuries: *Lazarillo de Tormes*, *Guzmán de Alfarache*, *La vida del Buscón*, and others.

Prerequisite: Spanish 312
Mr. Ryan

341 (I) NINETEENTH CENTURY SPANISH POETRY AND THEATER

Selections of poetry and theatrical works of both the Romantic and Realistic periods.

Prerequisite: Spanish 312
Staff

342 (II) NINETEENTH CENTURY SPANISH PROSE

Selections from costumbristic writers such as Larra and Mesonero Romanos, and novelists such as Alarcón, Pereda, Valera, and Pérez Galdós.

Prerequisite: Spanish 312
Staff

343 (I) GALDOS

Selected works of Spain's greatest modern novelist.

Prerequisite: Spanish 312
Mr. Navas-Ruiz

351 (I), 352 (II) THE GENERATION OF 1898

Selections from Gánivet, Unamuno, Valle Inclán, Baroja, Azorín, Machado, Miró, Pérez de Ayala, and Ortega.

Prerequisite: Spanish 312
Staff

353 (I) TWENTIETH CENTURY SPANISH POETRY

Selected readings from Juan Ramón Jiménez, the poets of the generation of 1927, and the post-war generation.

Prerequisite: Spanish 312
Miss Zardoya

354 (II) TWENTIETH CENTURY SPANISH THEATER

Selected readings from the major dramatists of the twentieth century.

Prerequisite: Spanish 312
Staff

**355 (I) TWENTIETH CENTURY
SPANISH FICTION**

Selected readings from the major novelists and short story writers of the twentieth century.

Prerequisite: Spanish 312 Staff

**361 (I) SPANISH LITERATURE
BEFORE 1500**

Readings from *El Cid* through the *Celestina*, including such works as *Libro de Buen Amor*, *El Conde Lucanor*, romances, and the poetry of el Marqués de Santillana, Jorge Manrique, and others.

Prerequisite: Spanish 312 Staff

**371 (I), 372 (II) SURVEY OF
SPANISH-AMERICAN LITERATURE**

Masterpieces from the Colonial period to the 20th century examined against the background of historical events, social pressures, and European literary movements.

Prerequisite: Spanish 312 Mrs. Walia

**373 (I) MODERN SPANISH-AMERICAN
NOVEL**

Extensive readings in the great works of contemporary Spanish-American prose. The major themes of man against nature, man against society, "indigenismo", "criollismo".

Prerequisite: Spanish 312 Staff

**374 (II) CONTEMPORARY SPANISH-
AMERICAN FICTION**

Spanish-American prose fiction from Borges to present-day writers.

Prerequisite: Spanish 312 Staff

375 (I) SPANISH-AMERICAN ESSAY

Selected readings from the works of the major essayists of the 19th and 20th centuries.

Prerequisite: Spanish 312 Mr. Alonso

**376 (II) CONTEMPORARY SPANISH-
AMERICAN POETRY**

Selections of Spanish-American poetry from Modernism to the present.

Prerequisite: Spanish 312 Mr. Navas-Ruiz

377 (I) MODERNISM

The Spanish-American modernist movement with attention to Poetry and Prose.

Prerequisite: Spanish 312 Mr. Navas-Ruiz

**381 (I) STUDIES IN SPANISH
LITERATURE**

Special topics or individual authors; topics vary from year to year.

Prerequisite: Spanish 312 Mr. Navas-Ruiz

**382 (II) STUDIES IN SPANISH-
AMERICAN LITERATURE**

Special topics or individual authors; topics vary from year to year.

Prerequisite: Spanish 312 Staff

383 (I or II) SENIOR SEMINAR

Guided research projects in Spanish or Spanish-American literature. Recommended for students planning graduate work, and those who plan to write an Honors Thesis.

Prerequisite: Senior standing and permission of the Department. Staff

**386 (II) METHODS AND PRACTICE
TEACHING OF SPANISH IN
SECONDARY SCHOOLS**

The issues, principles, and methods of secondary school Spanish teaching. Supervision and critique of practice teaching.

3 hours, 20 hours laboratory (practice teaching), 9 credits

Prerequisite: 6 hours Education courses and admission to Teacher Certification Program. Staff

THEATRE ARTS

COLLEGE I

ROBERT R. EVANS, PH.D., Assistant Professor of Theatre Arts and Chairman of Theatre Arts, College I.

COLLEGE II

LOUIS E. ROBERTS, PH.D., Assistant Professor of Theatre Arts and Chairman of Theatre Arts, College II.

GRADUATION REQUIREMENTS

Courses in Theatre Arts are offered at three levels: Introductory, Intermediate, and Advanced. Introductory Courses require no prerequisites and are directed to the student body as a whole. Intermediate Courses are workshops, courses in drama taught by other Departments of the University, and introductions to special areas of inquiry intended to provide basic knowledge of the field. Advanced Courses are given in the more specialized areas of theatre arts.

Summary of Requirements for Majors: Th 111, Th 123, Th 336, Th 335; four courses offered by other Departments in drama; two workshops; two Advanced Courses.

COURSE OFFERINGS

(3 hours, 3 credits unless specified)

111 (I) TRADITIONS OF WESTERN DRAMA

The intents, designs, and techniques of the drama of the Western World, from the classic Greek to the contemporary European and American theatre. Emphasis on the cultural environment of each of the major periods and locales of the drama and the relation of the theatre to its public.

3 hours, 4 credits

Mr. Roberts

121 (I) THE STYLES AND TECHNIQUES OF COMEDY

The comic form, emphasizing different styles, techniques, motivations and degrees of effectiveness of various exemplary comic playwrights, especially in their relation to their audiences, actors, and theatre architecture.

3 hours, 4 credits

Prerequisite: Sophomore standing

Mr. Evans

122 (II) THE STYLES AND TECHNIQUE OF TRAGEDY

The evolution of the tragic form, emphasizing different styles, techniques, motivations and degrees of effectiveness of various exemplary tragic playwrights, especially in relation to their audience, actors, and theatre architecture.

3 hours, 4 credits

Prerequisite: Sophomore standing

Mr. Evans

123 (I) STAGECRAFT I

Introduction to theatrical production: design considerations, theatre facilities, materials, scenery, lighting, sound, properties and costumes.

3 hours laboratory, 3 credits

Staff

212 (I) THEATRE OF SOCIAL PROTEST

An historical survey of the use of the theatre to challenge the values of society. The techniques of stagecraft used in different periods to reveal conflict in society, dramatize contemporary issues, and influence public opinion.

Prerequisite: Sophomore standing

Mr. Roberts

213 (II) THE AMERICAN THEATRE SINCE EUGENE O'NEILL

The rise and decline of the great period in

American playwriting and production. Emphasis on the Broadway theatre as a mirror-image of the ideas and events of American contemporary history since World War I.

Prerequisite: Sophomore standing

Mr. Evans

215 (I) MID-TWENTIETH CENTURY DRAMA

The ideas, values, and technique of the contemporary theatre as reflected in stage production.

Mr. Roberts

231 (I) WORKSHOP IN CLASSICAL DRAMA

Correlating selected texts of Greek or Roman drama with classical theories and methods of production. A survey of the production history of a work to be performed to observe how different ages have reflected themselves in classical drama. Students prepare director's notebooks, and participate in the production of one or more plays presented to the University community.

Prerequisite: Permission of instructor

Mr. Roberts

232 (II) WORKSHOP IN MODERN DRAMA

The texts of one or more plays written between 1870 and the present in preparation for performance. Attention to the playwright and his age, and to the various styles in which the work has been performed. Students participate in all aspects of course productions prepared for the University community.

Prerequisite: Permission of instructor

Mr. Evans

233 (I) WORKSHOP IN NINETEENTH CENTURY DRAMA

The connection between the text of a play and the work as performance, with attention to the playwright and his age and to the production history of works performed. Written work may include a director's notebook and program notes; students participate in one or more productions presented to the University community.

Prerequisite: Permission of instructor

Mr. Roberts

235 (II) INTRODUCTION TO DIRECTING

The understanding of dramatic form required in directing. A survey of theories of production and the director's function. A study of artistic creation fusing the spoken

word, movement, gesture, sound, light, color, fabric, design and architecture.

Prerequisite: Permission of instructor

Mr. Roberts

236 (I) INTRODUCTION TO ACTING

Dramatic form required in acting. A survey of various styles — Greek, *commedia*, Elizabethan, romantic, and realistic — and the actor's function. Emphasis on recently evolved methods of acting, and on the preparation of scenes in class.

Prerequisite: Permission of instructor

Mr. Evans

251 (I) PLAYWRITING I

Writing for the theatre, including examination of model one-act and three-act plays by major contemporary writers, selected readings on the craft of playwriting, and completion of an original play begun in class.

Prerequisite: Sophomore standing

Mr. Evans

260 (I) DESIGN I

Theatre as art form in cultural and popular expression: function of the designer, application of elementary scenery and costumes as given in stagecraft classes, methods of pictorial representation.

1 hour lecture, 3 hours laboratory, 3 credits

Prerequisite: Permission of instructor

Staff

300 (I) SEMINAR IN THE SCENIC IMAGINATION

The creative principles of stage production, based on an analysis of the playscript in its relation to the stage action, setting, cos-

tumes and lighting. Study of scenic metaphor and a review of the historic forms of staging, with emphasis on the modern styles from naturalism to absurdism and epic theatre.

Prerequisite: Permission of instructor

Staff

335 (II) INTRODUCTION TO DIRECTING II

Advanced work in directing, including the mounting of scenes and one-act plays.

Prerequisite: Introduction to Directing I

Mr. Evans

336 (I) INTRODUCTION TO ACTING II

Advanced work in acting, including the mounting of scenes and one-act plays.

Prerequisite: Introduction to Acting I

Mr. Roberts

351 (II) PLAYWRITING II

Writing for the theatre, with emphasis on the three-act form, including the construction of a scenario and completion of a draft of an original three-act play.

Prerequisite: Playwriting I

Mr. Roberts

360 (II) DESIGN II

Physical characteristics of the assigned play, together with its characters — tragic, lyric, comic, etc., to be embodied in theatrical terms. Finished sketches of eight to ten scenes painted per semester. The expressive stage environment.

1 hour lecture, 2 hours laboratory, 3 credits

Prerequisite: Design I or permission of instructor

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WILLARD W. PRINCE, *Assistant Director for Planning*

WILLIAM MEEHAN, *Assistant Director of Operations*

PUBLIC RELATIONS

JOHN J. LARNER, *Director*

Location of Departments, University of Massachusetts at Boston

MAP KEY

Building 1—100 Arlington St.

Audio Visual—2nd floor
Auditorium—basement
Auxiliary Services—1st floor
Biology Department—12th floor
Bursar's Office—1st floor
Chancellor's Office—12th floor
Chemistry Department—13th floor
College Preparatory Program—7th floor
Dean of Faculties Office—12th floor
Educational Planning—12th floor
Grant Development & Community
Services—12th floor
Health Services—mezzanine
Language Laboratories—8–11th floor
Natural Sciences Office—13th floor
Physics Department—13th floor
Public Relations Office—12th floor
Science Laboratories—8–11th floor
Science Library—mezzanine
Student Affairs Office—12th floor
Treasurer's Office—1st floor
Vice Chancellor's Office—12th floor

Building 2—142 Berkeley St. (Sawyer Bldg.)

Advising Office—4th floor
Afro-American Studies—4th floor
Bookstore—1st floor
Cafeteria—basement
Financial Aid—4th floor
Special Admissions—4th floor
Student Activities Office—4th floor
Vocational Counseling & Placement
Office—4th floor

Building 3—105 Arlington St.

Library

Building 4—330 Stuart St. (Salada Bldg.)

Anthropology Department—8th floor
Art Department—2nd floor
Dean's Office—College 1—2nd floor
Economics Department—6th floor
History Department—6th floor
and 8th floor

Institute for Learning & Teaching—
5th floor
Sociology Department—8th floor
University Senate—2nd floor

Building 5—172 Columbus Ave. (Hale
Bldg.)

English Department—1st and 2nd
floors

Building 6—131 Arlington St. (Avis
Bldg.)

Business Office—2nd floor
Personnel Office—2nd floor
Physical Plant Office—1st floor
Registrar's Office—1st floor

Building 7—80 Boylston St. (Little Bldg.)

French Department—6th floor
Italian Department—6th floor

Mathematics Department—8th floor
Spanish Department—6th floor

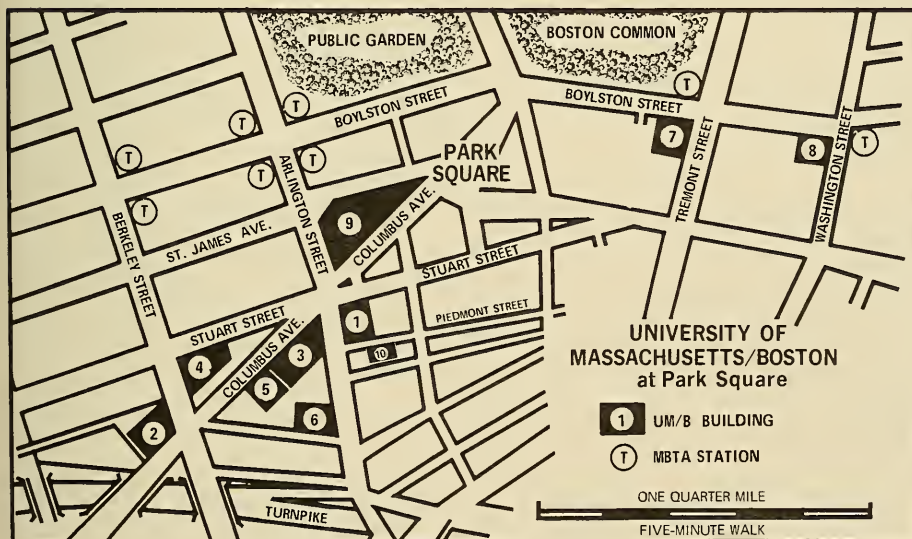
Building 8—20 Boylston St. (Century
Bldg.)

Music Department
Philosophy Department
Survey Research Program

Building 9—Statler Hilton

Classics Department—5th floor
Computer Planning Office—5th floor
Dean's Office—College II—5th floor
German Department—5th floor
Planning & Development—5th floor
Politics Department—5th floor
Psychology Department—5th floor
Russian Department—5th floor
Theatre Arts Department—5th floor

Building 10—42–44 Piedmont St.
Admissions Office



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Trustees of the University

Organization of 1972

ROBERT M. ABRAMS of Holyoke
FRANK L. BOYDEN of Deerfield
KEVIN R. CARMAN '72 of Cambridge
EDMUND J. CROCE of Worcester
DENNIS M. CROWLEY of Boston
ROBERT D. GORDON of Lincoln
JOHN W. HAIGIS, JR. of Greenfield
JOSEPH P. HEALEY of Arlington
MRS. ELIOT S. KNOWLES of South Dartmouth
LORENZO D. LAMBSON of Southwick
JOHN J. MAGINNIS of Worcester
GEORGE L. PUMPHRET of Dorchester
MRS. GEORGE R. ROWLAND of Osterville
LEE H. SANDWEN '72 of Annandale, Virginia
ALAN SHALER of Easthampton
MRS. O. PHILLIP SNOWDEN of Roxbury
FREDERICK S. TROY of Boston
CHRISTOPHER J. WELDON of Springfield

Ex Officio

NATHAN CHANDLER of Sterling Junction
Commissioner of Agriculture
HENRY W. KOLBE of Pondville
Commissioner of Public Health
MILTON GREENBLATT of Newton
Commissioner of Mental Health
MERLE L. HOWES of Amherst
Chairman of Board of Selectmen
FRANCIS W. SARGENT of Dover
Governor of the Commonwealth
NEIL V. SULLIVAN of Cambridge
Commissioner of Education
ROBERT WOOD of Lincoln
President of the University

Officers of the Board

JOSEPH P. HEALEY of Arlington, *Chairman*
FRANK L. BOYDEN of Deerfield, *Honorary Chairman*
ROBERT J. MCCARTNEY of Amherst, *Secretary*
KENNETH W. JOHNSON of Amherst, *Treasurer*

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Parents Newsletter

University of Massachusetts at Amherst

VOL. LXIV, No. 4

University of Massachusetts Bulletin

March 1972

Scholarship Aid Is Increased

A UMass scholarship fund is in line for a "gift" of as much as \$140,000.

This "gift" is not voluntary but the result of an undergraduate's push to force some 24,000 people to pay fines they owe for violating campus parking regulations over the past three years.

The student forced payment by entering a suit into the General Court of Justice—a student judiciary—claiming that he was being deprived of a source of financial assistance if fines were not collected. All money collected from parking fines goes into an unrestricted scholarship fund.

("Restricted" scholarships are awarded students who meet certain conditions—for example: place of residence, academic average, or year of studies. "Unrestricted" scholarships have no such conditions.)

In response to the suit, the student-run court in December instructed the Student Attorney

General to arrange for collection of fines by the Northampton District Court.

UMass should start receiving portions of the "gift" before this semester ends. The Northampton District Court and Student Attorney General began sending letters to violators early in March, informing them that they must pay or contest the fine within 30 days, or they will be issued a District Court summons. Failure to pay could result in loss of driver's license and registration.

The letters are being mailed 1,000 at a time, every other week, to the 24,000 violators. Among the first 1,000 to receive letters are 450 who owe more than \$100; the rest in the first group owe at least \$30.

Eight students have been hired, through the University's work-study program, to provide clerical assistance to the District Court in collecting the "gift."

Among those owing fines are students, faculty and staff members, and visitors. Students with cars registered to park on campus owe \$35,000; faculty and staff members owe \$4,000; and drivers of vehicles not registered to park on campus—which includes many students and visitors—owe \$99,000.

(The present court action is directed at collection of the \$39,000 owed by drivers of campus-registered vehicles. Further action by the Student Attorney General will be directed at collection of the \$99,000.)

About \$30,000 in Traffic Fines Scholarships was awarded this year, and Mr. Gerald Miller of the Financial Aid Office hopes that the added pressure on parking violators will increase the amount awarded next year.

... Courtesy of the Student Courts

The parking fines ruling by the student General Court spotlights the work of the student judicial system as a whole. More than 50 undergraduates are involved in the system, which operates on four levels of judiciary authority—House Judiciaries, Area Judiciaries, the General Court, and the University Discipline Board.

House and Area Judiciaries hear cases from within prescribed physical boundaries. A student accused of property destruction in a residence hall, for instance, or of any other offense within a residence hall, would have his case heard by the House Judiciary set up by the residence hall government.

This is the normal procedure of a House Judiciary, but a student may choose to have his case heard by the Area Judiciary instead of the House Judiciary.

Area Judiciaries, of which there are four, hear cases from within their respective areas but outside of the residence halls. One is set up for the residential area of fraternity and sorority houses, another for the non-residential part of campus, and one each for the residential areas of the eastern and western sides of campus.

Area West Judiciary, for instance, would handle the case of an unauthorized sale of a dining commons meal ticket in Southwest, and the

non-residential Area Judiciary would handle the case of a bookstore theft. The four Area Judiciaries are composed of five students each. Besides hearing cases such as the above, Area Judiciaries also serve as appellate boards for House Judiciary decisions.

The nine-member General Court, which heard the parking fines suit, is primarily appellate, hearing appeals of action taken by the two lower level boards—House and Area Judiciaries. In addition it hears cases involving student organizations, such as questions of legality of Student Senate legislation. The General Court and the Area Judiciaries also often hear cases occurring within the jurisdiction of boards lower than them, bypassing the lower level.

The University Discipline Board, composed of four students and four faculty members, is the highest campus appellate body. Any case may be appealed there, and every one involving a penalty of suspension or dismissal must be heard by the Board before becoming effective.

Besides the more than 30 students involved in the judicial system as justices on the various boards, about 25 more serve as student "advocates," trained to offer assistance and counsel to students having cases heard for or against them in the student judicial system.

Training and supervising the "advocates" is a student attorney general of the Student Senate. He is also the senate's advocate in any action involving it in the judicial system. In the parking fines case, he is the judiciary's representative working with the University's administration and the Northampton District Court in coordinating the collection of fines.

The student judiciaries use two types of penalties—those they impose themselves and those they recommend to the campus administration. Different court levels may impose or recommend different penalties. Among those they may impose are: a task in service to the University, restitution, probation, or a letter of censure. Penalties they may recommend are: expulsion, suspension, and jeopardy (suspended suspension).

During the past academic year, when two Area Judiciaries—the General Court and the Discipline Board—were operative, student courts heard 248 cases involving 263 students. The Discipline Board heard 13 appeals involving 15 students, and the other judiciaries handled 235 cases involving 248 students.

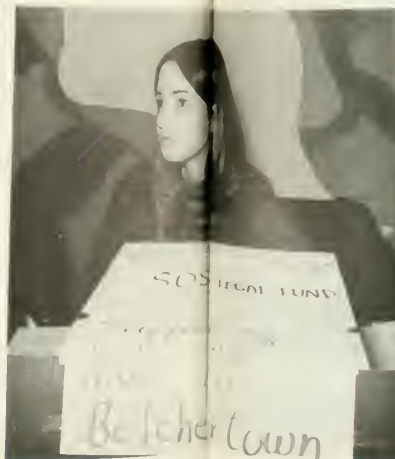
This year two more Area Judiciaries have been added, to cover fraternity-sorority and non-residential areas.



Where Students Gather

Since our Murray D. Lincoln Campus Center opened in July, 1970, it has taken on a character all its own. It's a center of campus activity of all kinds — some of which are shown in these photos.

At left is one of the 15 to 18 student craft tables. Below left, a student studies between classes. Center, one of several social service tables manned by students — in this case to help residents of Taubertown State School for the Mentally Retarded. At right, philosophers of East and West come together. Below right, one of 13 pinball machines which the past year brought in \$40,000 in dimes and quarters — \$20,000 of which will help decrease student Campus Center fees.



Arcon Guides Ready To Give Tours

In classic Greek, Arcon means leader. At UMass-Amherst, it means the student guide service.

For seven years, volunteer Arcon guides have been showing visitors around the 1100-acre UMass-Amherst campus. Arcon guides are all volunteers selected by the Interfraternity Council.

This is the first year sorority women have been showing visitors around the 1100-acre UMass-Amherst campus. Arcon guides are all volunteers selected by the Interfraternity Council.

Rapid changes in the campus and new programs have placed much responsibility on the Arcon guides, who contribute at least one hour a week to the tours. They have to be prepared to answer any questions about the University that students, parents or other visitors may ask.

"Over 100 guide candidates are screened each year, and of these 22 are chosen for their dedication to service, enthusiasm, ability to speak well, and interest in meeting people," said guide service advisor Samuel J. Lussier, Jr., assistant dean of admissions.

The Greek letters for "arcon" decorate sports jackets worn by the men and gray blazers worn by the women guides who conduct tours seven days a week—1:30 to 3:30 p.m. weekdays, 9 a.m. to 12:30 p.m. Saturdays, and 1 to 3 p.m. Sundays. To schedule a tour of campus, write Arcon Guide Service, Campus Center, University of Massachusetts, Amherst, Mass. 01002. The Arcon telephone is 545-2707, and guides are based on the main concourse level (level 2) of the Campus Center.

Last year the Arcon guides escorted 8,500 persons through the UMass campus. The busiest period is the fall semester, when High School Guest Days are conducted for some 1,200 students and teachers visiting the campus.

Security Director on the Job

An advisor to the Governor's Committee on Law Enforcement has been named director of security at UMass.

David L. Johnston, 35, was appointed to the post by Dr. Randolph W. Bromery, Acting Chancellor at UMass-Amherst.

As director of security, Mr. Johnston will work under Dr. Robert W. Gage, Acting Vice Chancellor for Student Affairs.

Since July, 1971, Mr. Johnston has been an advisor to the Governor's Committee on Law Enforcement and Administration, with specific responsibility for Criminal Justice Systems development. He also designed strategies for improving municipal police departments, and helped develop the State's 1972 Comprehensive Criminal Justice Plan.

He earned his bachelor of science degree at The School of Police Administration and Public Safety, Michigan State University, with a major in law enforcement administration; and his master of arts degree at the State University of New York. And he is completing his Ph.D. at The School of Criminal Justice, State University of New York at Albany, where his major is the planned change in criminal justice.

He has been a police officer for the Saginaw Police Department in Michigan; and has worked for the Department of Probation in New York City; the Troy, N.Y., Police Department; the Connecticut Department of Corrections; the Pennsylvania Department of Social Welfare Project; and the Oakland, Calif., Police Department.

Come to the Ballgame

The UMass athletic department offers a quality schedule of home baseball games during the spring. The Redmen are perennial challengers for the New England championship.

Home games for 1972 are: April 14, Holy Cross, 3 p.m.; April 15, Boston University, two games, 12 p.m.; April 18, Dartmouth, 3:30 p.m.; April 22, Rhode Island, 1 p.m.; April 25, Amherst College, 3:30 p.m.; May 1, Williams, 3:30 p.m.; May 5, New Hampshire, 3:30 p.m.; May 9, Boston College, 3:30 p.m.; May 13, Connecticut, 1 p.m.; and May 15, Harvard, 3:30 p.m.

Lorden Baseball Field is in the northwest section of campus, near the Boyden Physical Education Building.

There is no charge for admission to baseball games, and no charge for home contests in track, lacrosse, tennis, and golf. Schedules may be obtained from the Sports Information Office, Boyden Building, University of Massachusetts, Amherst, Mass. 01002. Telephone (413) 545-2439.

Spring football practice for the Redmen will terminate with the annual intrasquad game Saturday, April 29, at 2 p.m. in Alumni Stadium. The game will climax a morning of clinics for high school coaches.

There will be an admission charge of \$1 for adults and 50 cents for children. Further information is available from the Football Office. Telephone: (413) 545-2453.

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**PARENTS NEWSLETTER
FOR PARENTS AND FRIENDS
OF THE UNIVERSITY**



Parents Newsletter

University of Massachusetts at Amherst

VOL. LXIV, No. 5

University of Massachusetts Bulletin

June 1972



Commencement Speakers Said: (Excerpts)

"This is my first commencement as Chancellor of the Amherst campus. . . . I want to take this opportunity to publicly thank all of the members of the campus community, the President and his staff, and the Board of Trustees for your vote of confidence in me and your support by giving me the opportunity to serve as the Chancellor of this campus. I welcome the challenge to participate with you in building this institution into a quality, and I hope, a unique public university, dedicated to serving all of the citizens of Massachusetts. My commitment is to the education of the sons and daughters of the Commonwealth by working with them in forging an environment in which it is possible for each of us to become more aware and caring human beings.

. . . Chancellor Randolph W. Bromery

* * *

"It may be that there was once an option to stand aloof from the general scene. An indifferent citizen could let the Establishment direct the course of public affairs. That option no longer exists. All of us need to be committed to the public life. That commitment means participation, not observation; it means decisions, not reflection; it means action, as well as education."

. . . President Robert Wood

* * *

"What are the traditional functions of the university over a period of seven or eight centuries? They are three-fold and all three are interrelated: To preserve the cultural heritage of the past and pass it on to succeeding generations; to train young men for the professions of theology, law, medicine and—eventually—public service; and—since the opening of Gottingen in 1737—to expand the boundaries of knowledge through original research."

. . . Historian Henry Steele Commager,
main speaker

* * *

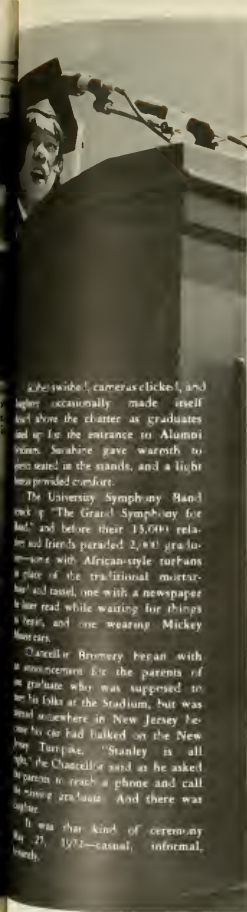
"... there should be an attempt on our part to try and make God believe in us. It's easy to believe in Him, but for Him to believe in us, we've got to believe in ourselves, and that involves thought and self-knowledge. This belief in myself as man inspires a belief in you, another person, as well as a belief in mankind—to trust, the way God planned it. Maybe he put us here as different sexes, nationalities, races, religions, and classes to see how long it would take us to see each other as one."

. . . Student Speaker Danny T. Hom
(pictured at podium, next page.)



Carol Ann Bromery adjusts the doctoral hood for her father, Chancellor Randolph W. Bromery, as her brother, Keith Marcel, looks on. Carol and Keith received bachelor's degrees as their father presided over his first Commencement as UMass Chancellor.





Johnniebel cameras clicked, and later occasionally made itself not above the chatter as graduates and up for the entrance to Alumni Union. Sunshine gave warmth to people seated in the stands, and a light breeze provided comfort.

The University Symphony Band took up "The Grand Symphony for Grad" and before their 15,000 relatives and friends paraded 2,000 graduates with African-style turbans and a piece of the traditional mortarboard and tassel, one with a newspaper which read while waiting for things to start, and one wearing Mickey Mouse ears.

Chancellor Bromery began with a announcement for the parents of the graduate who was supposed to be in the folks at the Stadium, but was found somewhere in New Jersey because he or she had talked on the New York Telephone. "Stanley is all right," the Chancellor said as he asked the person to reach a phone and call the missing graduate. And there was laughter.

It was that kind of ceremony May 27, 1972—casual, informal, friendly.



Class Gift
The Class of '72 gift to UMass was \$3,000 to purchase books for the soon-to-open 28-story library.



Honorary Degrees

Honorary degrees were awarded to eight distinguished persons at the UMass 102nd Commencement. Historian Henry Steele Commager, main speaker, received a Doctor of Humane Letters degree. Other recipients: Episcopal Bishop of Massachusetts John M. Burgess, Holyoke Community College President George E. Frost, choral conductor and actor Jeter Hairston, Brown University Dean of Academic Affairs Jacquelyn Anderson Mattfeld, former UMass Dean of Physical Education and Athletic Director Warren P. McGuirk, Nobel Prize-winning economist Paul A. Samuelson, and Boston Museum of Science Director Henry Bradford Washburn, Jr.



Special Programs

Among the thousands who received degrees May 27 were 60 who had studied under special programs. The first graduating class of CCEBS (Committee for the Collegiate Education of Black Students) contained 44 students, the first class of BDIC (Bachelor's Degree with Individual Concentration) had 22, and the first "class" of the Bachelor's Degree in General Studies had one.

Since Last We Wrote . . .

ROTC

ROTC courses taught by Military and Air Science personnel will no longer carry academic credit. Trustees voted the new policy May 10; it had been recommended by the UMass-Amherst Faculty Senate November, 1969 and again April 27, 1972. ROTC courses taught in regular University academic departments will still carry academic credit.

Student Fees

Trustees have approved an Undergraduate Activities Tax of \$33.50 and a Distinguished Visitors Program tax of \$1.50 for the next academic year. The Activities Tax—which was \$2 more last year—supports about 40 student organizations and activities, and the DVP brings well-known speakers to the campus. The Senior Class Tax was established at \$1 and the Campus Center Fee set at \$0.20.

Stockbridge Fees

Student Activities Fees for the Stockbridge School of Agriculture have been increased \$8 a year by Trustees. Effective next academic year: Class of '73 students will pay \$28 first semester and \$26 second semester; Class of '74 students on a two-full-semesters basis will pay \$28 first semester and \$25 second semester; and Class of '74 early placement students, who leave before the end of second semester for jobs, will pay \$28 first semester and \$20 second semester.

New Buildings

Four modular buildings to supplement academic classroom and office space and four new greenhouses have been approved by Trustees. The modular buildings, ranging in size from 8,000 square feet to 30,000 square feet will be used to relocate personnel and facilities from older University buildings which will be renovated and remodeled, and to allow more space for some academic departments. A \$2 million State appropriation will buy the buildings, install them on campus, and furnish them. They are expected to be ready for use by early next spring. Each greenhouse will be 1,000 square feet and all will be connected to Morrill Science Center which houses the botany department. The facility, which will cost approximately \$225,000, is scheduled for completion in November, 1972.



Fiftieth For Stockbridge

Stockbridge School of Agriculture bestowed associate degrees upon 229 at the School's 50th Commencement May 26.

Senior Class President Kathleen Hannigan announced a special class gift — \$500 for development of a picnic site on the University's farm in Deerfield — and said she hoped future Stockbridge classes would contribute to the fund.

Stockbridge Director John W. Denison praised the School's golf team which ended the season with five wins, two ties, and one loss.

Dr. Robert L. Gluckstern, UMass Vice Chancellor for Academic Affairs, gave the main address, in which he told Stockbridge, "For many years you have carried more than your share of responsibility to serve the needs of the Commonwealth. Your new programs are clearly aimed at satisfying the increasing demand on the part of students for relevant, technically oriented courses, and on the part of society for technically trained students to address our serious problems in the next decade."

Stockbridge Director John W. Denison presented degrees to students who studied under 13 programs at the School: agricultural business management; animal science; arboriculture and park management; environmental technology; floriculture; food distribution; food processing technology; fruit and vegetable crops; hotel, restaurant and travel administration; laboratory animal technology; landscape operations; turf management; and wood utilization.



Philip Dagnault of Ware shows his Stockbridge degree to his niece and nephews — Brian, left; Nicole, and Chris.

Tuition Increased

Higher tuition for all in-state undergraduates, and increases in room and telephone fees at the Amherst campus have been voted by the Board of Trustees.

Tuition will go up 50 per cent over the next two years, rent for most of the rooms at UMass-Amherst will go up \$30 per year, and the fee for telephones in rooms at Amherst will be raised from \$25 to \$38 per year. All increases take effect Sept. 1.

The tuition increases follow recommendations made Aug. 8 by the board chairmen and chief executive officers of the major segments of public higher education and by the Board of Higher Education. The tuition for in-state undergraduates, now \$200 per year, will go to \$250 this September and to \$300 in September of 1973, a 50 per cent increase over the two years.

The room rent increase will affect all students living on campus—except those in the Sylvan Area, a three-building complex where rents are at the top rate of \$700 per year.

All other rents will go up \$30 per year. In the newer residences in the Orchard Hill and Southwest Areas, and in three renovated buildings in other areas, rents that are now \$610 per year will go up to \$640. In all other buildings, rents that are now \$550 per year will go up to \$580. The renovated buildings are Lewis, Thatcher and Chadbourne.

Memo To Students Re: Vice Chancellor

If you have any nominations for Vice Chancellor for Student Affairs, the Search Committee would welcome them by Aug. 1.

The Committee is composed of 11 students and six faculty and staff representatives. Individual students have an opportunity to participate in the nominating this summer, and campus organizations will have that same opportunity in early fall. Selection will be in the fall.

Nominations, and suggestions of people—from on or off campus—who might help the Committee, should be sent to Ms. Marjorie P. Lenn, chairwoman; Search Committee for the Vice Chancellor for Student Affairs; Chancellor's Office; Whitmore; University of Massachusetts; Amherst, Mass. 01002.

Dr. Robert W. Gage is Acting Vice Chancellor for Student Affairs.

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The Redmen football season will begin Saturday, Sept. 23, as the UMass team faces the Blackbears from the University of Maine at the UMass Alumni Stadium. Tickets will be \$3, and the game will begin at 1 p.m., as do all home games. Parents are invited to bring tailgate picnic lunches.

Homecoming will be Oct. 28 when the UMass Redmen meet the University of Connecticut Huskies.

Other home games: Oct. 14, Boston University; Nov. 18, University of New Hampshire; Nov. 25, Boston College. Tickets and information may be obtained from Walter R. Novak, Athletic Department, Boyden Building, University of Massachusetts, Amherst, Mass. 01002. Tel. (413) 545-0810.

The away game schedule: Sept. 30, Harvard; Oct. 7, University of Vermont; Oct. 21, University of Rhode Island; Nov. 11, Holy Cross; Nov. 4, Bucknell.

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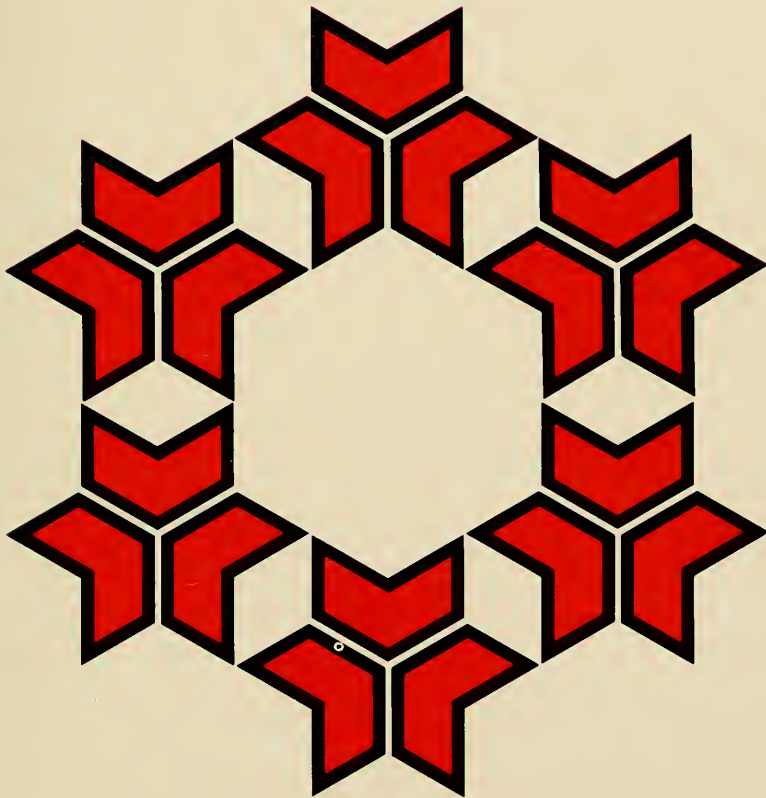
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**PARENTS NEWSLETTER
FOR PARENTS AND FRIENDS
OF THE UNIVERSITY**

1973-74

University of Massachusetts Bulletin

Graduate School



VOLUME LXIV

Number 9

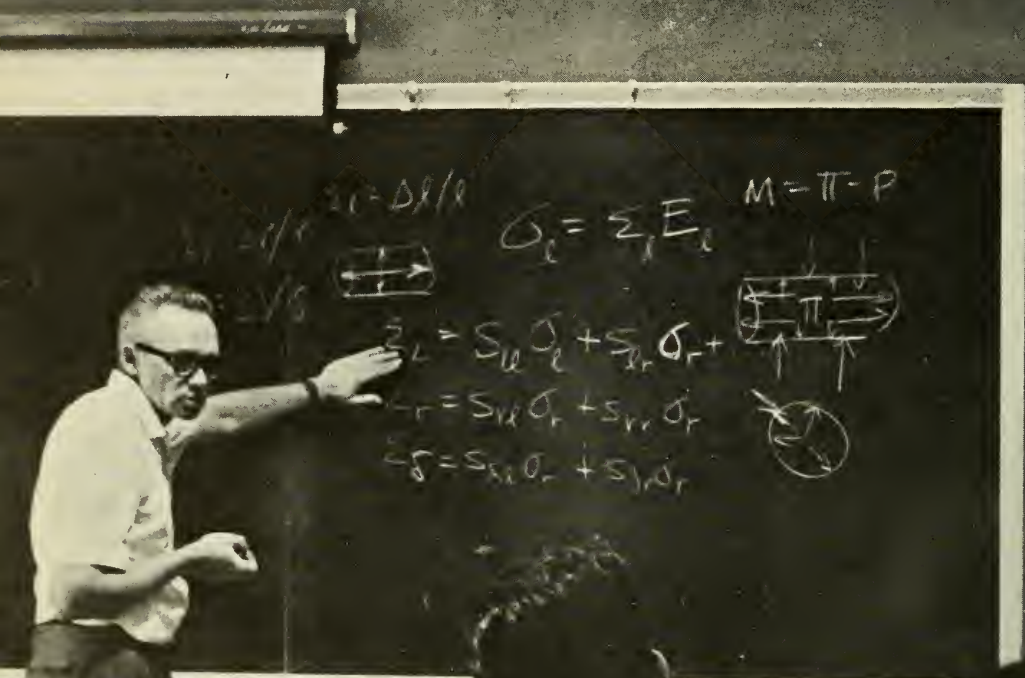
November 1972

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Information contained in this Bulletin is current as of November 1, 1972.

*University of Massachusetts at Amherst
1973–74 Graduate School Bulletin*





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1972-73 Academic Calendar

Wednesday, September 6	Registration for graduate students
Friday, September 8	Classes begin
Thursday, September 21	Last day to add courses
Monday, October 9	Holiday
Thursday, October 19	Last day to drop courses (with DR)
Saturday, October 21	Graduate Foreign Language Tests
Monday, October 23	Holiday
Tuesday, October 24	Last day on which May 1973 Ph.D. and Ed.D. candidates may take preliminary comprehensives
Monday, November 13	Counseling Period begins for students in residence
Friday, November 17	Counseling Period ends
Wednesday, November 22	Thanksgiving Recess begins after last class
Monday, November 27	Thanksgiving Recess ends, 8:00 a.m.
Saturday, December 9	Graduate Foreign Language Tests
Friday, December 15	Final examinations begin
Saturday, December 23	Final examinations end
Saturday, December 23	Christmas Recess begins, 12:30 p.m.
Monday, January 22	Last day on which May 1973 master's candidates may submit approved thesis outlines
Tuesday, January 23	Registration for graduate students
Thursday, January 25	Classes begin
Wednesday, February 7	Last day to add courses
Saturday, February 10	Graduate Foreign Language Tests
Monday, February 19	Holiday
Wednesday, March 7	Last day to drop courses (with DR)
Friday, March 23	Spring Recess begins after last class
Monday, April 2	Classes resume, 8:00 a.m.
Monday, April 16	Holiday
Friday, April 20	Last day on which September 1973 master's degree candidates may submit approved thesis outlines
Saturday, April 21	Graduate Foreign Language Tests
Monday, April 23	Counseling Period begins for students in residence (classes not suspended)
Friday, April 27	Counseling Period ends
Tuesday, May 15	Final examinations begin
Wednesday, May 23	Final examinations end
Saturday, May 26	Commencement
Saturday, June 16	Graduate Foreign Language Tests
Saturday, July 21	Graduate Foreign Language Tests
Friday, August 24	Last day on which January 1974 master's degree candidates may submit approved thesis outlines

1973-74 Academic Calendar

Wednesday, September 5	Registration for graduate students
Friday, September 7	Classes begin
Thursday, September 20	Last day to add courses
Monday, October 8	Holiday
Sunday, October 14	Graduate Foreign Language Tests
Thursday, October 18	Last day to drop courses
Monday, October 22	Holiday
Wednesday, October 24	Last day on which May 1974 Ph.D. and Ed.D. candidates may take preliminary comprehensive examinations
Monday, November 12	Counseling Period begins for students in residence (classes not suspended)
Saturday, November 17	Counseling Period ends
Wednesday, November 21	Thanksgiving Recess begins after last class
Monday, November 26	Thanksgiving Recess ends, 8:00 a.m.
Friday, December 14	Final examinations begin
Saturday, December 22	Final examinations end
Saturday, December 22	Christmas Recess begins, 12:30 p.m.
Tuesday, January 22	Last day on which May 1974 master's candidates may submit approved thesis outlines
Tuesday, January 29	Registration for graduate students
Thursday, January 31	Classes begin
Sunday, February 3	Graduate Foreign Language Tests
Wednesday, February 13	Last day to add courses
Monday, February 18	Holiday
Friday, March 13	Last day to drop courses
Friday, March 22	Spring Recess begins after last class
Monday, April 1	Classes resume, 8:00 a.m.
Sunday, April 14	Graduate Foreign Language Tests
Monday, April 15	Holiday
Friday, April 19	Last day on which September 1974 master's degree candidates may submit approved thesis outlines
Monday, April 22	Counseling Period begins for students in residence (classes not suspended)
Friday, April 26	Counseling Period ends
Monday, May 20	Final examinations begin
Monday, May 27	Final examinations end
Saturday, June 1	Commencement
Sunday, July 28	Graduate Foreign Language Tests
Friday, August 23	Last day on which January 1975 master's degree candidates may submit approved thesis outlines



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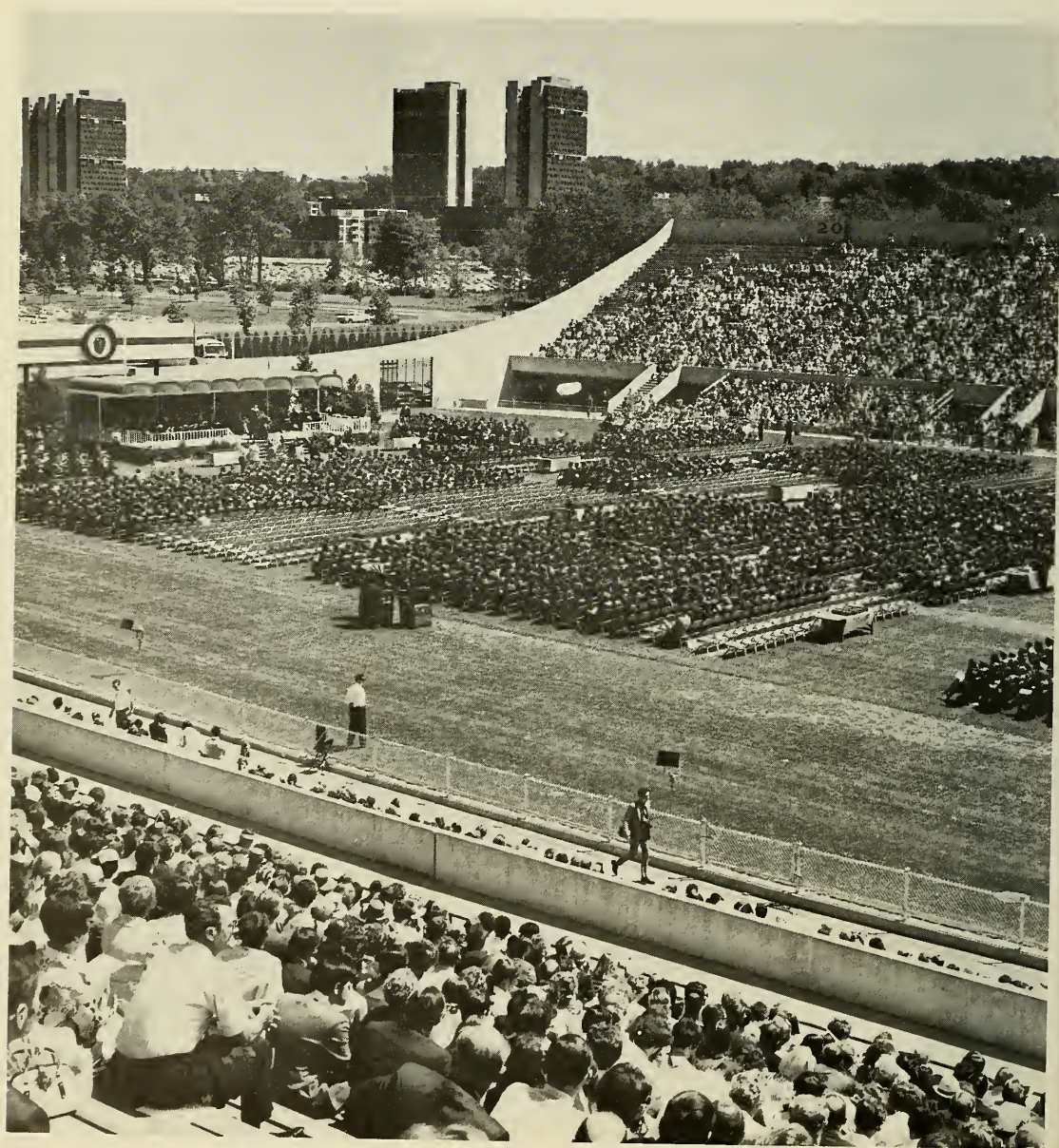
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General Information

The University

The University of Massachusetts is the state university of the Commonwealth. It was founded in 1863 under the provisions of the Morrill Land Grant Act passed by the United States Congress one year earlier.

Situated in one of the most picturesque sections of the state, the University at Amherst joins with its academic neighbors—Amherst, Smith, Mount Holyoke, and Hampshire Colleges—in maintaining the rich tradition of education and cultural activity associated with the Connecticut Valley region. The University's Amherst campus consists of approximately 1,100 acres of land and 110 buildings. Physical growth has been carefully planned, with provisions or additional buildings and facilities to accommodate an enrollment of approximately 25,000 students by 1975.

The Dean of the Graduate School, in collaboration with the University Graduate Council, exercises overall review and supervision of graduate programs conducted in the several colleges and provides guidance in the development of new programs as well as the maintenance of standards for existing programs. Each college of the University has developed its graduate programs in accordance with the highest national professional standards of the respective fields.

For information about University of Massachusetts at Boston graduate programs, consult the *University of Massachusetts at Boston Bulletin*.

Information on graduate programs in medicine is found in the *University of Massachusetts at Worcester Medical School Catalogue*.

COLLEGES CONDUCTING GRADUATE PROGRAMS

Eight colleges and schools of the University and one unaffiliated department are authorized to offer graduate degrees through the Graduate School: the College of Arts and Sciences, the College of Food and Natural Resources, the School of Business Administration, the School of

Education, the School of Engineering, the School of Home Economics, the School of Nursing, the School of Physical Education, and the Department of Public Health.

UNIVERSITY LIBRARY

The University Library system is composed of the main University Library, which will open in a new building during the 1972-73 academic year, and several branch libraries. Present holdings include over 1,100,000 books, periodical volumes, and government documents, and over 250,000 microforms. All holdings of the University Library and its branches are listed in the public catalog, situated on the main level of the University Library. More than 10,000 periodicals are currently received and distributed, according to subject matter, in the University Library or its branch libraries. Holdings and locations are listed in both the card catalog and the *Pioneer Valley Union List of Journal and Serial Holdings*, a computer-produced book that also includes serial listings of Amherst, Smith, and Mount Holyoke Colleges and the Hampshire Inter-Library Center. A computer project to provide on-line access to all University serial holdings is currently underway. The Library is a depository for U.S. Government publications and also regularly receives many categories of publications from the United Nations and other international agencies and from the Commonwealth, cities, and towns of Massachusetts.

The main University Library contains the major portion of the entire Library collection, including most of the Library's holdings in the social sciences and humanities. The public catalog, reference collection, microform collection, newspapers, and a selection of current periodicals are on the main level. Circulation charging and return desks are on the entrance level, while the reserve-book desk is on the second floor.

The principal branch libraries are the Morrill Biological Sciences Library in the Morrill Science Center and the Physical Sciences Library in the Graduate Research Center.

Hours of the libraries vary, but schedules are posted in all libraries and announced in University news publications. A library handbook and information series is available at the reference desk of the University Library as well as in the branch libraries. Librarians are on duty in the University Library and the two branch libraries to assist the University community in using the Library and its collections.

HAMPSHIRE INTER-LIBRARY CENTER

The University Library is a participating member of the Hampshire Inter-Library Center, a cooperative facility for the acquisition, storage, and servicing of research materials, especially journals, documents, and scholarly sets. Incorporated in 1951 to augment library resources in the area, HILC is jointly operated by the libraries of the five Connecticut Valley colleges—Amherst, Hampshire, Mount Holyoke, Smith, and the University of Massachusetts—and the Forbes Library of Northampton, Massachusetts. The HILC collection numbers about 35,000 bound volumes, and approximately 1,000 journals are received currently. The Center is currently located on the second level of Goodell Library.

THE UNIVERSITY COMPUTING CENTER

The University Computing Center provides the computing services required to support the instruction and research activities of the faculty and students of the University. Computing services include both batch and time-sharing operations. A large number of popular programming languages and an extensive library are available through the batch system. The time-sharing system allows access to the computer from over 100 terminals located around the campus. As many as 96 simultaneous users can be accommodated. The languages available are FORTRAN, BASIC, APL, and a number of special purpose languages such as COGO, MIMIC, and MIXAL. Users can maintain and share their private libraries as well as have access to a large public library.

In addition to the computing services, the University Computing Center offers many user services, including application programming, consulting, library, program assistance, and key-punching. Short courses in programming and various languages and the use of various systems are offered as needed by the community. Formal full-term courses in computing techniques are offered by the Computer and Information Science Program.

The equipment of the University Computing

Center consists of a CDC 3800 and a CDC 3600 which share four 32K banks of core storage. Peripheral devices include drums, disk drives, tape drives, card readers, printers, card punch, and a PDP-8 and TEMPO I computer. Off-line equipment includes plotter, verifiers, collator, sorter, and accounting machines.

LABOR RELATIONS AND RESEARCH CENTER

The Labor Relations and Research Center conducts research in the field of labor relations, provides consultation services, and supports a regular program of academic course work. A Master of Science degree in Labor Relations is described elsewhere in this Bulletin. Inquiries should be addressed to the Director of the Labor Relations and Research Center, 125 Draper Hall, University of Massachusetts, Amherst, MA 01002.

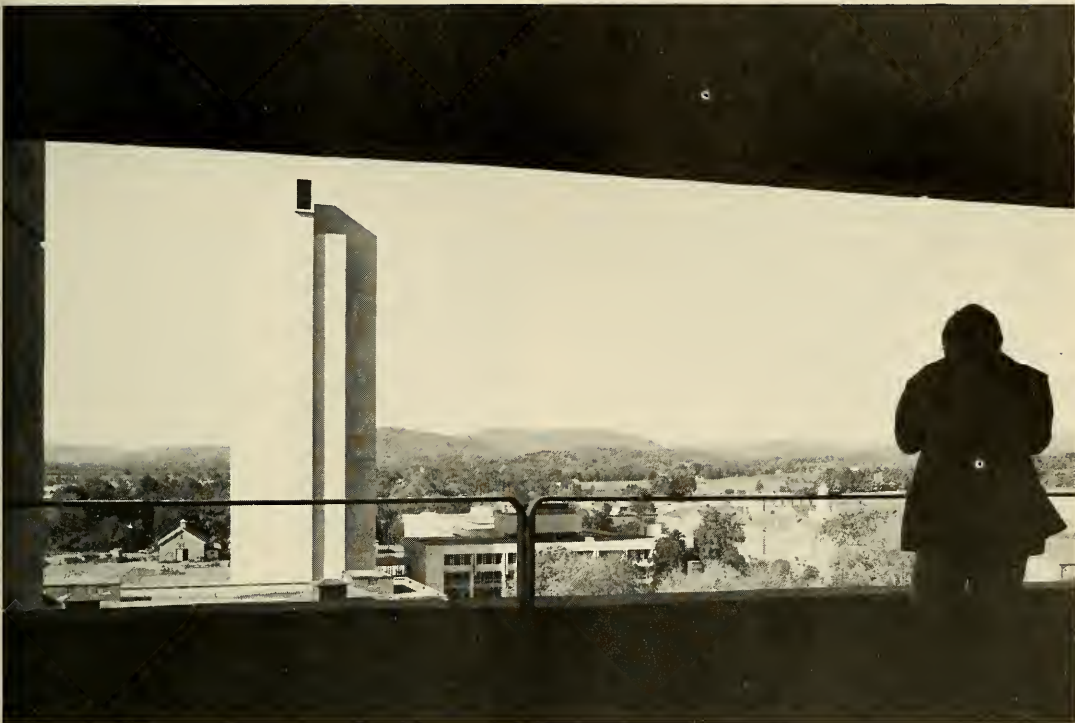
WATER RESOURCES RESEARCH CENTER

The Water Resources Research Center at the University's Amherst campus supports research in the planning and development of water and related land resources. Areas covered include engineering, economics, and hydrogeology; management and decision-making institutions; and the ecology of wetlands, rivers, lakes, and coastal waters. Through its research the Center also provides training opportunities for persons interested in master's and doctoral degrees in water resources-related fields. The Center assists the various departments in the development of new and strengthened water resources programs and courses.

THE MARINE STATION

The Marine Station of the University of Massachusetts is located about half-way between Rockport and Gloucester on the North Shore of Cape Ann. The laboratory was formerly the quarters of the Consolidated Lobster Company, which for years processed and distributed fish products for Boston and New York. The main laboratory building is located at the end of a peninsula jutting out into Ipswich Bay. Adjacent to the laboratory are 200 feet of docks and floats where deep draft vessels are easily moored. The laboratory operates a 45-foot research vessel, the R.V. Bigelow, named after the famous oceanographer, Henry B. Bigelow. The vessel is equipped with deep-sea winches and all-weather laboratory space.

The close proximity of the laboratory to the fishing activities of Gloucester and the science-industrial complex along Route 128 provides a



unique opportunity for cooperative research efforts. The laboratory staff of 15 year-round employees directs research oriented toward understanding the physical and chemical processes associated with the growth of marine organisms.

The main laboratory is essentially equipped for biochemical studies, containing culturing facilities, dark rooms, instrument rooms, running seawater, research offices, and a library. Research studies include: physical and biochemical factors affecting the augmentation of growth of phytoplankton in the Gulf of Maine, biochemical cycling of plant material, influence of temperature on photosynthesis and respiration of phytoplankton, general metabolism and energetics of marine shellfish, biochemical factors influencing the penetration of solar radiation in seawater, and nitrogen metabolism of attached algae.

Opportunities exist for qualified graduate students to do research at the Station. Through the School of Continuing Education two courses are offered in the area of the environmental physiology of invertebrates and algae. For further information see the section on the Marine Sciences program.

UNIVERSITY OF MASSACHUSETTS

DEPARTMENTS OF MILITARY AND AIR SCIENCE

Seniors and graduate students with two years of academic study remaining who are interested in becoming commissioned officers in the United States Army or United States Air Force may apply to the Department of Military Science or to the Department of Air Science, respectively, for a two-year commissioning program. Selected students receive \$100 per month and are granted Selective Service deferments. Two-year scholarships are available for qualified applicants. Those interested should consult the head of either department at least six months prior to the beginning of their final two years at the University. Early application is necessary for administrative processing. Candidates must pass an aptitude test, a physical examination, and attend a six-week summer camp.

UNIVERSITY OF MASSACHUSETTS ABROAD

FREIBURG PROGRAM

The Freiburg Program, begun in 1966-67, offers to graduate students and selected upper-division

undergraduates an opportunity for a year of advanced studies in the humanities, social sciences, and arts at the University of Freiburg, Germany. Although a good command of German is necessary for admission, the program is not restricted to students concentrating in German language and literature. However, a superior academic record is required for admission. Accepted students may enroll in a wide variety of courses at the University of Freiburg, including political science, comparative literature, philosophy, economics, music, and German language and literature.

The program is directed in Freiburg by a member of the University of Massachusetts faculty and is headquartered in the University of Massachusetts Study Center in Freiburg. The relationship between the two universities is developing into a genuine partnership, with a yearly exchange of students and faculty from each institution.

Students from other colleges and universities are eligible to apply for admission to the Freiburg Program. Undergraduates apply through the Office of International Programs, Whitmore Administration Building. Students from other colleges and universities applying to study in the Freiburg Program at the graduate level must apply to the Graduate School of the University of Massachusetts as well as to the International Programs Office.

Basic cost of the program is estimated at about \$2,300 annually, including international travel, room and board, tuition and fees. Scholarships are available to outstanding students, and Fulbright scholarships may be applied to participation in the Freiburg Program. Applications and additional information are available at the Office of International Programs.

SUMMER PROGRAM AT FREIBURG

The Department of Germanic Languages and Literatures sponsors a six-week summer program in West Berlin and Freiburg, Germany. Courses in elementary, intermediate, and advanced German are offered, and students may earn up to 6 University of Massachusetts credits. There is a three-week period for independent travel in Europe between the initial week in Berlin and the five weeks spent in Freiburg.

The course fee for the program is \$850 (\$880 for non-residents of Massachusetts). This fee covers round-trip international travel, tuition, room and board, special excursions, and lectures which supplement the basic program.

Although primarily for undergraduates, the

program is open to graduate students as well. One of its aims is to offer to students enrolling in the one-year Freiburg Program the opportunity to gain greater proficiency in German prior to participation in that program.

For further information contact the Department of Germanic Languages and Literatures, Herter Hall.

SUMMER PROGRAM AT BOLOGNA

The Summer Program in Italy, held in Bologna from late June to the end of August, is not geared specifically to any one discipline or to language study. Italy—its language, its history, and its people—is the focus of all courses, and each acquires an added dimension by virtue of the fact that it is taught in the country itself. The curriculum includes graduate and undergraduate courses in the fields of history, art history, Italian language and literature, cultural anthropology, and other related fields. Field trips to major cultural centers in Italy are an integral part of the program. The program is open to students from other colleges and universities as well as to University of Massachusetts students, but enrollment is limited to 60 students. Any student in good academic standing is eligible to apply. Although knowledge of Italian is not a prerequisite, prospective applicants are encouraged to take at least one year of Italian so as to derive the greatest possible benefit from their stay in Italy. Enrollment in the program costs \$850; this includes international travel, tuition, field trips, housing, and partial board in Bologna. Expenses for the free travel time at the conclusion of the program are additional and should be budgeted for. For further information contact the Director, Bologna Program, Department of French and Italian, Herter Hall.

SUMMER STUDIES AT PAU

The Department of Romance Languages sponsors French studies at both the undergraduate and graduate levels for six weeks (early July to mid-August) at Pau in southwest France. A year of college French or the equivalent is prerequisite. Students are placed in courses according to their level of ability; the program offers courses in language, stylistics, literature, and civilization. The professorial staff is from the French university system, particularly from the Universities of Bordeaux and Toulouse. Up to 6 University of Massachusetts credits may be earned, and the successful participants will receive a "certificat d'assiduité" from the University of Pau.

The Pau Program students depart from Boston



in mid-June and return in late August, which allows three weeks for independent travel before the academic program begins. Enrollment in the program costs \$775; this includes international travel, tuition and books, room and board at Pau, and excursions arranged by Pau University. A limited number of scholarships is available. Further information may be obtained from: French Studies at Pau, Department of Romance Languages, Herter Hall.

SUMMER PROGRAM AT OXFORD

A special group of courses in English literature is regularly offered at Trinity College, Oxford, during July and part of August. The six-week session is part of the regular Summer Session of the University of Massachusetts and awards University of Massachusetts credit. Courses are taught by Oxford, with the Bodleian Library available for extensive research. Graduate and undergraduate courses are offered, subject matter varying according to the availability of specialists at Oxford and the interests of students. Special evening lectures by noted authorities supplement course offerings. Students from colleges and universities other than the University of Massachusetts are also eligible. Admission requirements include 15 hours of credit in literature and good academic standing. The overall cost to the student is \$875. To apply, contact Dr. Ernest Hofer, Department of English, Bartlett Hall.

UNIVERSITY OF MASSACHUSETTS

SUMMER PROGRAM AT MADRID

In its summer program at Madrid, mid-June to mid-August, the Department of Hispanic Languages and Literature offers two graduate seminars, two courses open to graduates, seniors, and approved juniors, and one undergraduate course. All are conducted in Spanish and carry three credits each. The normal course load is 6 credits. The purposes of the program are: 1. to provide access for qualified students to intensive advanced work in literature and the history of ideas, 2. to offer the experience of total immersion in the Spanish language and culture, 3. to introduce students to Spanish scholars and creative intellectuals and artists who have not come to the United States to teach. Among the distinguished faculty for 1972 were Pedro Laín Entralgo, José Olivio Jiménez, Keliodoro Carpintero, Carmen Bravo-Villasante and José Luis Alonso-Misol. In addition to a six-week course of study, the program offers supplementary lectures, visits to theaters and concerts, and integrated weekend trips. Fees include tuition, room and board in a selected private home, lectures, and excursions. The program fee for Massachusetts residents is \$675, to non-residents \$705. (This fee does not include transportation.) Applicants should contact Prof. Blanche De Puy, Director, Hispanic Languages Department, Herter Hall.

FIELD COURSE IN CULTURAL ANTHROPOLOGY, ST. VINCENT, WEST INDIES

The Anthropology Department offers an eight-week field course in cultural anthropology to graduate and selected undergraduate students in anthropology. The purpose of the course is to give students a supervised introduction to cultural anthropological field work, the foundation of a professional career in anthropology.

The course is given in June and July. The first week is devoted to orientation and familiarization with the culture of St. Vincent in the capital, Kingstown. This is followed by six weeks' residence in research sites selected on the basis of both student and government interest. Research activities in the field are closely supervised by the director of the program, and students return to Kingstown periodically for brief seminars to compare and discuss their progress and problems. The final week's work, held in Kingstown, is devoted to presentation of preliminary results, evaluation, discussions with officials of Government, and planning for publication of final reports.

Costs of the program, including round-trip air



transportation from New York, tuition, room and board, and program-related transportation, is \$600 (\$700 for non-residents of Massachusetts). Limited financial aid is available. Students earn 6 University of Massachusetts credits. Further information may be obtained from Professor T. M. Fraser, Department of Anthropology, Machmer Hall.

FIELD PROGRAM IN ANTHROPOLOGY, EUROPE

The Anthropology Department offers a field program in anthropology open to graduate and advanced undergraduate students in anthropology. Lasting for a period of either four or seven months, the course is designed to provide serious students preparing for careers in anthropology with an extended period of field research in Europe under the guidance of an experienced field worker. The program is held each spring semester, with an option to extend the period of research through the summer available to selected participants.

Directorship of the program rotates among the faculty members of the Department's European Studies Committee. Location of the program in Europe in any given year depends upon who is directing the program. Each participant selects a field site in accordance with his interests and training, but within the country or group of coun-

tries designated by the director. The first few weeks in the field each student conducts a survey of the region in which his field is located before taking up residence at the site. Supervision of all field activities is provided by the director. All participants assemble periodically in a central location for short seminars, to discuss their problems and progress. A final seminar, during the last week of the program, is devoted to the presentation and evaluation of preliminary results.

Prerequisites for participation in the program include a working-knowledge of the language required for field research, and prior course work in both field methods and in the culture area where research is to be conducted. Students interested in participation in the program should submit to the program director a proposal outlining the research they hope to accomplish. The proposal should be submitted during the fall preceding the spring in which the applicant wishes to participate in the program. A format for such a proposal, as well as additional information about the program, is available from the Chairman of the European Studies Committee, Anthropology Department, Machmer Hall.

A limited number of stipends is available to offset costs of international travel and maintenance while in the field.



Application Procedures for Admission and Readmission

Holders of bachelor's degrees, from this University or from other institutions having substantially the same requirements for the bachelor's degree, are eligible to apply for admission to a program of graduate studies. Admission is only for the semester requested and can not guarantee admission at a later date. Application blanks may be obtained by writing to the Graduate Admissions Office, Graduate Research Center, University of Massachusetts, Amherst, Massachusetts 01002. Application for admission, with supporting documents, should be sent in duplicate to the Graduate Admissions Office so as to be received by April 15 for September enrollment, by October 1 for January enrollment, and by March 1 for Summer Session enrollment. Applications received after these dates can be considered only if space is available.

Admission to the Graduate School does not necessarily indicate admission to candidacy for an advanced degree. Such candidacy is subject to specific requirements as defined by the individual departments. The student must secure the approval of the Head of the Department in which

he desires to major before he can become a candidate for a degree in that subject.

Applicants can be admitted to the Graduate School in one of the following categories:

Degree status: a student admitted as fully qualified to undertake a program toward a graduate degree.

Provisional status: a student admitted on a probationary status. At the conclusion of a semester of work—or two semesters if the department stipulates—the student is either admitted to degree status or refused admission. If he is admitted to degree status, credits earned while in a provisional status are acceptable toward his degree if approved by his Guidance Committee.

Graduate Special Status: open to students who have a bachelor's degree or its equivalent. A student may enroll for a maximum of 12 credits or two consecutive enrollment periods (including Summer Session) whichever comes first. This status may not be renewed beyond the credit/time limitation regulation as stated above. Graduate credits earned may be applied toward a graduate degree at this institution, subject to acceptance into a degree program, and provided the credits are acceptable to the department/school.

Graduate Non-Degree Status: open to students who have a bachelor's degree or its equivalent. Acceptance is for one calendar year, and credits earned under this status are not—and will not become—applicable toward a graduate degree at this University. This status may be renewed upon its expiration, provided the student is in good academic standing.

REQUIREMENTS FOR ADMISSION

1. A minimum cumulative grade point average of 2.75.
2. A bachelor's degree or the equivalent from any college or university of recognized standing.
3. Two official transcripts of all previous college work (undergraduate and graduate).

An applicant should request the registrar of all colleges previously attended to send two copies of the transcript directly to the Graduate Admissions Office. Transcripts should be sent as soon as the first semester grades of the final year's work have been recorded. A final transcript showing that the bachelor's degree has been awarded must be received before the applicant enters the Graduate School.

4. Two letters of recommendation from persons in the field of the applicant's academic major at the institution most recently attended. Appli-

cants whose academic record goes back more than five years may substitute other references, subject to departmental acceptance.

5. The Graduate Record Examination (Aptitude and Advanced Tests) should be submitted for admission to the Graduate School. The Advanced Test must be taken in the field of study in which the applicant intends to earn a degree. Each applicant should have a transcript of his scores sent to the Graduate Admissions Office. Applicants are urged to take the Graduate Record Examination at the November testing or earlier. The results of later testings are frequently not available before decisions on admission must be made. The Educational Testing Service, 20 Nassau Street, Princeton, New Jersey 08540, or Box 27896, Los Angeles, California administers the test in the United States as well as abroad. Addresses of test centers can be obtained from them. On this campus the test is given by the University Guidance Office.

Applicants for admission to the School of Business Administration are required to take the Admission Test for Graduate Study in Business rather than the Graduate Record Examination. This test is also administered by the Educational Testing Service. Inquiries concerning it should be addressed to the Service.

6. For foreign student requirements see section entitled Foreign Applicants.

7. Acceptance by the department and the Graduate Admissions Committee of the Graduate Council.

FOREIGN APPLICANTS

The Graduate School welcomes applications from non-citizens of the United States. A brochure entitled "Information for Prospective Students from Other Countries" giving detailed information of use to foreign students, is available from the Graduate Admissions Office and should be consulted. Foreign applicants must complete their applications at least nine months prior to the registration date of the first semester of study.

The Test of English as a Foreign Language (TOEFL) is required of all applicants for admission to the Graduate School from countries whose native language is not English. Information about the examination may be obtained by writing:

Test of English as a Foreign Language
Educational Testing Service
Princeton, New Jersey 08540 U.S.A.

TOEFL may be waived if the applicant has attended an American college or university for a period of at least two academic years. A score of



550 or above is required for admission. Students scoring between 500 and 549 who otherwise meet the requirements set by departments may be admitted provided they agree to attend, at their own expense, in the summer prior to admission, a summer institute in English such as the program of the Experiment in International Living at Putney, Vermont. All non-native-speakers of English who are admitted will be tested by the University on arrival before registration, whether or not they have submitted TOEFL. Students scoring below the established minimum will be required to take further work in English. The program of study of graduate students taking remedial English work is subject to limitation by the Graduate School.

Foreign applicants must normally apply and be admitted for full-time degree candidacy.

ADMISSION OF FACULTY AND STAFF MEMBERS TO GRADUATE STUDY

A member of the faculty of the University with the rank of assistant professor or higher may not earn a graduate degree from the University. He may, however, do graduate work on a non-degree basis. A full-time staff member of the University may not carry more than 4 credits per semester.

READMISSION

A student or applicant who falls into one of these categories must reapply:

1. An applicant who has previously been admitted to the University but did not enroll on the entrance date stated in the acceptance letter;

2. A graduate student at this University who was accepted for one degree program and wishes to apply for another program or degree; and

3. A degree candidate who has not enrolled in courses or paid the Program Fee (see next section) must reapply and pay all associated fees.



Tuition and Fees

TUITION

All graduate students pay tuition at the following rates: Residents of Massachusetts—\$22.50/credit hour up to \$225 per semester; non-residents—\$45/credit hour up to \$450 per semester. In order to register as a Massachusetts resident, a student must have on file a Certificate of Residence properly authenticated by his Town or City Clerk.

GENERAL FEES

(also see Medical-Surgical Section)

Graduate students enrolled for 5 or more credit hours are assessed \$68 per semester. This General Fee includes such facilities and services as Infirmary, Campus Center, I.D. Card, and Graduate Student Senate Tax. The General Fee is NOT optional.

Graduate students enrolled for less than 5 credit hours are assessed \$18 per semester. This fee includes an I.D. card, Graduate Student Senate Tax, and one-half of the Campus Center charge. Infirmary service is optional at \$35 per semester if enrolled for less than 5 credit hours.

During the Summer Session tuition charges are as stated above, but fees are assessed on a weekly basis.

TUITION AND FEE CHANGE

Tuition and fees are subject to change upon action of the Board of Trustees and may be changed without prior notice.

PROGRAM FEES

Graduate students not enrolled for any course credits but who are candidates for a degree, must

pay a Program Fee of \$10 each semester until the degree for which the student has been accepted has been awarded. Deadline for payment of this fee is two weeks from the first day of classes. If a student does not pay this fee but later seeks readmission or applies for graduation, he shall pay the accumulated Program Fees plus a readmission fee of \$50. Students seeking readmission must secure a Reapplication form from the Graduate Admissions Office and follow the procedure described under the Readmission section.

COMMENCEMENT FEE

There is a \$10 Commencement Fee requisite for graduation. This fee must be paid by the time a student files for graduation.

MEDICAL-SURGICAL INSURANCE

An optional medical-surgical insurance plan supplements the care received by students at the Infirmary. It provides hospital, medical, and surgical care on a twelve-month basis for illness or injuries received during the school year as well as holidays, summer vacation, and other times when the student is off campus. Students who register for the fall semester have only one opportunity to enter or reject this program each year, at the time of payment of the fall semester bill. It is also offered on the spring semester bill for new spring registrants only. The fee for medical-surgical insurance is approximately \$30 per year. Married students desiring family coverage under the plan now in existence at the University are advised to contact the Student Health Services. The cost of family coverage is an additional \$35 (approximate) per quarter.

STUDENT FINANCES

Students should arrive on campus with enough cash on hand to pay their tuition, fees, and insurance bills as well as room and board for at least one month after registration. Normally, this will be between \$400 and \$500. (Students receiving financial assistance from or through the University will not receive their first checks for approximately three to four weeks after registration.)

WAIVER OF TUITION AND FEES

Holders of certain titles are exempt from tuition and certain fees. Waiver forms must be processed prior to registration in order to take advantage of exemptions.

WAIVER OF TUITION

Full-Time Community College Faculty

The Trustees of the University of Massachusetts have authorized waiver of tuition, but not fees,



for faculty members of the Massachusetts Regional Community Colleges taking courses at the University of Massachusetts, providing the faculty members are full-time before taking such courses and return to full-time teaching in their Community College after completion of course work. When a faculty member who is eligible for such a tuition waiver desires to take a course at the University, his Community College President should supply him with a memorandum certifying that he is a full-time faculty member. Such waivers will apply for the period from September 1 to the following August 31. Such faculty members must be accepted for admission by the Graduate School prior to any registration.

Vietnam Veterans

Tuition may be waived for any Vietnam veteran, as defined in the General Laws, whose service was credited to the Commonwealth. Any veteran eligible for this waiver is advised to contact the Veterans Coordinator, Whitmore Administration Building, for further information.

TUITION AND FEE REFUNDS

A student who leaves the University for any reason before a semester is completed, except as specified below, will be granted a pro rata refund of tuition and fees. A student who makes an advance payment and then for any reason does not attend any part of the next semester or term at the University will be given full refund of tuition and fees. A student who is involuntarily called into military service before the completion of a semester will be given pro rata refund of tuition and fees provided he receives no academic credit for work of that semester. If academic credit is given, there will be no refund. A student who is

suspended or expelled from the University for disciplinary reasons forfeits all rights to a refund.

Refunds are first applied to reimburse scholarships or loan funds (up to the full amount), and any remaining amount is refunded to the student.

REFUND SCHEDULE

Regular Term

- a. Within the first two weeks from the beginning of semester or term—(Registration Day)—80%
- b. During the third week—60%
- c. During the fourth week—40%
- d. During the fifth week—20%
- e. After the fifth week—No refund

Summer Session

- a. During the first week—60%
- b. During the second week—20%
- c. After the second week—No refund

RENT

The charge per semester is \$382.50 including telephone facilities, which are not optional. A deposit of \$100 is required before any assignment can be made.

ROOM RENT REFUNDS

It is the policy of the University that there will be no refund of room rent after the semester has begun. A student who has made an advance payment of room rent will be granted a full refund of prepaid room rent if he fails to attend any part of the next semester or term or does not reside in a residence hall or other University housing. Students involuntarily called to military service will be granted a refund on a pro rata basis. Once occupying a room, students are responsible for the entire semester's rent and will be billed accordingly.

BOARD

The cost for each semester is \$306.50 for 15 meals per week or \$271.50 for 10 meals per week. Food service will be available weekends on an individual purchase basis. Students under 21 years of age who reside in a dormitory are required to pay University board. Other students may purchase individual meals on a cash basis.

BOARD REFUNDS

Authorized refunds will be made on a pro rata basis. A student who is suspended or expelled from the University for disciplinary reasons forfeits all right to a refund.



Housing

The University provides a limited amount of housing on campus for married and single graduate students. Information relating to off-campus housing should be requested from the Off-Campus Housing Office, Room 236, Whitmore Administration Building.

At present, one of the residence halls in the Southwest Residential College is reserved for use by unmarried graduate students. Prince House is a four-story building containing three large social-lounge areas, a recreation room, a television room, vending machines, and a snack lounge. Student bedrooms are for double occupancy only. Terms of occupancy are indicated below:

1. Space in the building will be assigned on a full-semester basis only.

2. Both American and foreign single graduate students, male or female, are admitted to the limits of available space. Each individual assignment states the amount of board and room charged. The University reserves the right to alter fees whenever necessary.

3. Residence-hall rules and regulations require that occupants assume the responsibility for damage in and to their rooms; hot plates or any other equipment for preparing hot food are expressly prohibited.

4. No assignment will be made until the \$100 Room Security Deposit has been paid. This deposit is required of all students who live in University residence halls. It is not deductible from the semester bill and can be refunded only upon notification of withdrawal or of the student's plans to move off campus, *provided* such notification is given to the Housing Office no later than

forty-five days prior to registration day of each semester.

5. Upon acceptance to the Graduate School, the entering student will receive housing information and application form. While every effort is made to comply with requests, the University reserves the right to make room assignments in accord with existing vacancies. Early applications receive preference.

APARTMENTS FOR MARRIED STUDENTS

The University owns and manages 395 unfurnished apartment units of various sizes at three convenient locations on or near campus. A waiting list is established for entrance into University-owned housing and is maintained according to the date of application. Apartments are allocated as follows: 75% married graduate students, 20% married undergraduates, and 5% for University use. Information on assignment procedures, apartment descriptions, and application forms may be obtained from the Married Student Housing Office, Room 235, Whitmore Administration Building.

OFF-CAMPUS HOUSING

A card file of off-campus apartments, houses, and rooms is maintained at the Off-Campus Housing Office for use by any person connected with the University. Due to daily changes in these rental listings and the fact that all off-campus arrangements must be made directly by the parties involved, these listings cannot be secured except by a personal visit. Information concerning off-campus housing may be obtained from the Off-Campus Housing Office, Room 235, Whitmore Administration Building.

Fellowships, Assistantships, and Teaching Associateships

UNIVERSITY FELLOWSHIPS

University fellowships are unrestricted and are awarded to graduate students on a University-wide basis by competition. They are intended to encourage and assist superior students in pursuing graduate study and in completing the requirements for graduate degrees in the minimum possible time.

The stipend is \$2,800 for the academic year, payable in weekly installments from September through May. Fellowships provide for waiver of tuition, but not of fees and are not renewable beyond the third year. A recipient of a University fellowship must enroll as a full-time student.

Application forms are supplied as part of the regular admissions material by the Graduate Office of the University of Massachusetts. Completed applications must be submitted to the major department before February 1 for the following September. Awards are announced by April 15. Applicants not currently enrolled in graduate study at the University must also have filed an application for admission to the Graduate School.

FEDERAL FELLOWSHIPS

The University participates in the various Federal fellowship programs sponsored by the National Defense Education Act (NDEA), the National Science Foundation, and the National Institutes of Health. Suitable applicants are recommended by the academic departments.

OTHER FELLOWSHIPS

Direct fellowship awards are available from a number of foundations. Students may obtain information concerning these fellowships from the office of the Associate Graduate Dean for Research or the Assistant Graduate Dean.

GRADUATE ASSISTANTSHIPS AND ASSOCIATESHIPS

The University offers a number of graduate assistantships and associateships in the research and instructional programs of the various departments. Graduate assistants and associates are not required to pay tuition if their stipend is \$625 or more for the semester. A stipend of \$1,250 or more over two semesters entitles the assistant to a waiver of tuition during the following summer session. Application for a graduate assistantship is made to the Director of Graduate Studies in the department involved.



RESEARCH ASSISTANTSHIPS

A number of research assistantships are available to qualified graduate students. These are made possible through funds provided by various industries, the Experiment Station, and research grants awarded to members of the Graduate Faculty either from sources outside the University or from funds provided by the University and administered by the Research Council. Stipends vary with the type of work and the amount of time involved.

TEACHING ASSISTANTSHIPS

Many departments are able to offer teaching assistantships to qualified, regularly enrolled graduate students. A teaching assistant is normally required to devote between 15 and 20 hours per week in preparation and teaching. The stipend varies from \$3,400 to \$4,000 per academic year.

TEACHING ASSOCIATESHIPS

Superior achievement and ability among teaching assistants is recognized and rewarded by promotion to the position of Teaching Associate. The stipend for teaching associates ranges from \$3,800 to \$4,500 per academic year.

**NATIONAL DEFENSE LOANS AND
THE COLLEGE WORK-STUDY PROGRAM**
Graduate students may be eligible for National

Defense Loans and employment under the College Work-Study Program. Loans are awarded on the basis of need and funds available; however, no student may borrow in excess of \$10,000. The repayment period and the interest do not begin until nine months after the student ends his studies. The loans bear interest at the rate of three percent per year, and repayment of principal may be extended over a ten-year period. If a borrower becomes a teacher in an elementary or secondary school or in an institution of higher education, as much as half of the loan may be forgiven at the rate of 10 percent for each year of teaching service. Borrowers who elect to teach in certain eligible schools located in areas of pri-

marily low-income families may qualify for cancellation of their entire obligation at the rate of 15 percent per year. Repayment may be deferred up to a total of three years while a borrower is serving in the Armed Forces, with the Peace Corps, or as a Volunteer in Service to America (VISTA). Repayment also is deferred for as long as a borrower is enrolled at an institution of higher education.

Information concerning these programs may be obtained from the Financial Aid Office, Whitmore Administration Building.

The deadline for filing an application is March 1. Applications received after this date may not receive consideration.

Programs Offered

Major fields in which courses are offered leading to the degree of Doctor of Philosophy:

Agricultural and Food Economics
Animal Science
Anthropology
Astronomy
Biochemistry
Botany
Business Administration
Chemical Engineering
Chemistry
Civil Engineering
Comparative Literature
Computer and Information Science
Economics
Electrical Engineering
English
Entomology
Environmental Engineering
Food and Agricultural Engineering
Food Science and Technology
Forestry and Wood Technology
French
Geology
Germanic Languages and Literatures

Hispanic Languages and Literatures
History
Human Movement
Industrial Engineering and Operations Research
Linguistics
Mathematics
Mechanical Engineering
Microbiology
Nutrition and Food
Ocean Engineering
Philosophy
Physics
Plant Pathology
Plant Science
Political Science
Polymer Science and Engineering
Psychology
Sociology
Soil Science
Speech
Wildlife and Fisheries Biology
Zoology

An interdisciplinary Ph.D. with individual concentration may be awarded in exceptional circumstances. For detailed information apply to the Graduate Dean's Office.

In several fields, degrees are awarded under the Five-College Cooperative Ph.D. Program: All departments in the biological sciences; chemistry, French, geology, Germanic languages and literatures, philosophy, physics, and Hispanic languages and literatures.

Major fields in which courses are offered leading to the degree of Doctor of Education:

Curriculum and Instruction Specialists School Guidance
School Administration

Major fields in which courses are offered leading to the master's degree:

Agricultural and Food Economics
Animal Science
Anthropology
Art History
Astronomy
Biochemistry
Botany
Business Administration
Chemical Engineering
Chemistry
Civil Engineering
Comparative Literature
Computer and Information Science
Dramatic Arts
Economics
Education
Electrical Engineering
English
Entomology
Environmental Engineering
Fine Arts
Fisheries Biology
Food and Agricultural Engineering
Food Science and Technology
Forestry
French
Geology
Germanic Languages and Literatures
Hispanic Languages and Literatures
History
Home Economics

Industrial Engineering and Operations Research
Labor Studies
Landscape Architecture
Linguistics
Management Science
Marine Science
Mathematics
Mechanical Engineering
Microbiology
Music
Nursing
Nutrition and Food
Ocean Engineering
Philosophy
Physical Education
Physics
Plant and Soil Sciences
Plant Pathology
Political Science
Polymer Science and Engineering
Psychology
Public Administration
Public Health
Regional Planning
Slavic Languages and Literatures
Sociology
Speech
Statistics
Wildlife
Wood Technology
Zoology

DIVISION OF CONTINUING EDUCATION

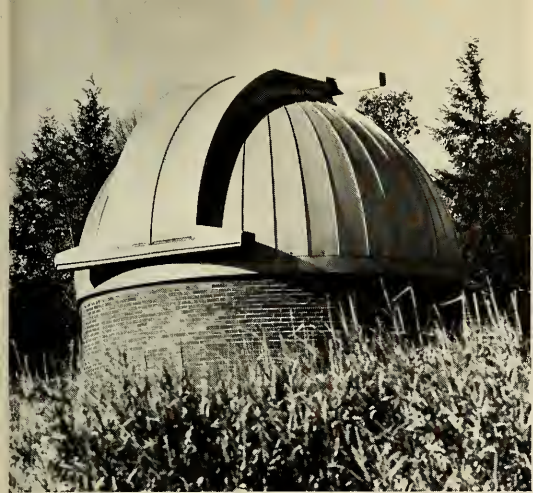
The Division of Continuing Education serves the residents of the Commonwealth for whom the more formal structures of education are not available or necessary. As an administrative unit, the Division perceives needs and matches resources to accommodate the part-time student whenever and wherever suitable for academic pursuits. Such needs are met through two basic channels: Academic Extension (graduate- and undergraduate-level credit programs) and Conference Services (a flexible noncredit schedule of conferences, institutes, workshops, and seminars). The main offices of Continuing Education are located in the Murray D. Lincoln Campus Center.

Academic Extension includes the Evening Division, with a hundred courses offered each semester, and special programs for off-campus credit courses. At Westover Air Force Base, for example, servicemen are enrolled in a master's

program in Education Management. Geographically, programs range from Martha's Vineyard to Africa and include such timely offerings as Project: SELF, a women's program that is expanding beyond the Pioneer Valley in an attempt to provide continuing education to a vital sector of the Commonwealth's population.

The Division, through its Conference Services, assists on- and off-campus groups to arrange conferences, institutes, short courses, and workshops to be held in the Campus Center or elsewhere on the Amherst campus or, if circumstances require, off campus as well. Arrangements include budgeting, publicity, housing, meals, meeting rooms, registration, transportation, audio-visual material, and bookkeeping.

In 1971, 42,293 persons participated in 168,005 conference days on the Amherst campus under the management of the Conference Services section of the Division of Continuing Education.



Doctoral Degree Requirements

All requirements for any advanced degrees to be awarded at a given degree-granting period (January, May, September) must be completed by the appropriate deadline which will be announced at least two months beforehand. The completed Eligibility for Degree forms must be submitted to the Graduate School by the specified deadline so that all the candidate's credentials can be certified before the degree is actually awarded. Refer to the *Graduate School Handbook* (copies available at the Graduate School) for further detailed guidance in the preparation through the completion of a program of study.

DOCTOR OF PHILOSOPHY AND DOCTOR OF EDUCATION

In order to provide proper direction for the doctoral candidate, a Guidance Committee shall be appointed as soon as the student arrives on campus. This Committee will be nominated by the Department Head or Chairman from the Department's Graduate Faculty; formal appointment will be made only by the Dean of the Graduate School.

The Guidance Committee will meet with the candidate as soon as practicable after the appointment has been made. This committee is responsible for:

- a. Approving the candidate's program of courses.
- b. Approving the procedure for satisfying the language requirements.
- c. Arranging for the candidate's preliminary comprehensive examination.
- d. Reporting fulfillment of the above re-

quirements to the Head of the Department. (A unanimous vote of the Guidance Committee is necessary in certifying fulfillment of these requirements.)

As soon as the student has passed his preliminary comprehensive examination, the Department Head or Chairman or Graduate Program Director of the candidate's major department* shall recommend to the Dean of the Graduate School the names of at least three members of the Graduate Faculty to serve as a Dissertation Committee. The Guidance Committee and the Dissertation Committee may be the same, although this is not necessarily the case. At least two of the Graduate Faculty so nominated shall be from the candidate's major department.* Where appropriate and feasible, one member shall be appointed from outside the candidate's department.* This outside member shall serve as the representative of the Graduate Council and shall, upon completion of the final oral examination, file a report with the Graduate Council pertaining to both the dissertation and the general procedures followed in the final oral examination. The outside member shall without exception be a voting member of the Dissertation Committee.

When it is not appropriate or feasible to appoint an outside member at the time the Dissertation Committee is formed, the Dean of the Graduate School shall appoint such a Graduate Faculty member as the representative of the Graduate Council prior to the candidate's final oral examination. This member will read the dissertation and participate as a voting member in the final oral examination, filing a report with the Graduate Council.

It shall be the responsibility of the Dissertation Committee to approve the dissertation project, to supervise its execution, and to arrange for the final examination of the student. All members of the Dissertation Committee must approve the dissertation before the final oral examination is scheduled. Attendance at the final oral examination is open to all members of the candidate's major department and any members of the Graduate Faculty. However, only members of the Dissertation Committee may cast votes. A unanimous vote of the Dissertation Committee is required for the student to pass the final oral examination. If, at the final examination, two members of the Dissertation Committee cast

*Refers to administrative entity for which degree has been authorized (i.e., department, program, school, etc.).

negative votes, the candidate will be informed that he has not passed the examination. If there is but one negative vote, the degree will be held up pending action of the Graduate Council.

The doctoral degree is conferred upon graduate students who have met the following requirements:

1. Preparation of a dissertation satisfactory to the Dissertation Committee and the Department Chairman or his designated representative.

2. Successful completion of those graduate courses in the major field which have been designated by the Guidance Committee.

3. Passing a preliminary comprehensive examination conducted by the major department (not later than eight months before the completion of the candidate's work). If the student fails the comprehensive examination he may, at the discretion of the Guidance Committee, be permitted a second chance and final examination.

4. Satisfactory completion of foreign language requirements under Graduate Council policy. (These requirements are listed in the departmental sections of this Bulletin.)

5. Passing a final at least partly oral examination conducted by the Dissertation Committee. This examination shall be primarily upon, but not limited to, the candidate's dissertation. This examination cannot be scheduled until all members of the Committee and the candidate's Department Chairman or Head (or his designatee) have approved the dissertation.

6. Satisfactory completion of the residence requirement. The equivalent of at least one academic year of full-time graduate work must be spent at this University. This requirement must be satisfied by the candidate's physical presence on campus for two consecutive semesters, either a fall-spring or a spring-fall sequence. It cannot be satisfied by a summer session and an adjoining semester of the regular academic year. The candidate need not reside in Amherst, and should not hold a full-time job during this period. If the candidate is a teacher in a school system in the area he may teach no more than one course while satisfying the residence requirement. This requirement is not stated in terms of credit hours because the candidate may satisfy the requirement while working on his dissertation-without being registered for a specific number of credits. The intent is that the candidate should be on campus so that the faculty can become acquainted with him and be able to recommend him in connection with his future career.

7. Credits for each graduate course become

invalid nine years following the date of completion of the course. However, graduate credits previously earned at another institution and officially accepted by the Graduate School toward the degree requirements shall become invalid nine years from the date of first registration in the doctoral degree program. The candidate must take a minimum of one half of his course work for the degree at the University. In cases where this would be less than the amount of course credit earned for a master's degree, the full credit of the master's degree may be accepted.

FIVE-COLLEGE COOPERATIVE PH.D. PROGRAM

A cooperative Ph.D. program is offered by Amherst, Hampshire, Mount Holyoke, and Smith Colleges, and the University of Massachusetts. The degree is awarded by this University, but in exceptional cases much or all the work leading to it may be taken at one or another of the sister institutions. Departments authorized to offer the cooperative Ph.D. degree are: all departments in the biological sciences, Chemistry, French, Geology, German, Philosophy, Physics, and Hispanic Languages.

An applicant must apply for the Five-College Cooperative Ph.D. Program through the Graduate School of the University of Massachusetts. The applicant must then secure the approval of the appropriate academic department at the University. The application then will be forwarded to the appropriate Five-College institution for its evaluation. The letter of acceptance to the applicant is sent only by the Dean of the Graduate School of the University of Massachusetts, not by the other cooperating institution.

Registration for the Five-College Cooperative Ph.D. students is handled only through the Graduate School of the University of Massachusetts.

Degrees awarded through this program will be appropriately indicated on the diploma, the permanent record card, all transcripts, and the Commencement Program.

All requirements for the 5-College Cooperative Ph.D. degree are similar to those for the Ph.D. degree at the University except for the residency requirement. Residence in this program will apply to the institution where the dissertation work is done.

The names of the Graduate Faculty at cooperating institutions are listed at the end of this Bulletin.



Doctoral Dissertation

A dissertation shall pertain to a topic in the field of the candidate's major subject, and must demonstrate that the candidate possesses the ability and imagination necessary to do independent constructive thinking.

The dissertation in its completed form will be judged largely upon the ability of the candidate to review literature and reach definite deductions; to formulate a problem, plan a method of attack, and work systematically toward a solution; to summarize his material and draw conclusions. Scholastic attainment in writing and presenting the results of the study will be crucial. The goal of the dissertation is to make a contribution to some body of knowledge. It should be of publishable quality. The following rules shall be adhered to in the preparation and presentation of a dissertation:

1. The professor responsible for the direction of the student's research shall be the chairman of the student's Dissertation Committee. Only members of the Graduate Faculty may be appointed to this committee.

2. It is the responsibility of the Chairman of the Dissertation Committee to arrange a conference with other members of the Committee and the candidate to discuss the research problem before approving the dissertation outline.

3. A copy of the candidate's dissertation outline must be signed by each member of the Dissertation Committee both to indicate his approval of the outline and that a conference

with the candidate has been held. The signed copy of the outline or prospectus shall then be sent to the Dean of the Graduate School.

4. The Dissertation Committee shall have complete charge of all matters pertaining to the dissertation. The dissertation must have the unanimous approval of this Committee and the approval of the Department Head or Chairman before arrangements are made for the final examination for the degree.

5. Two copies of the dissertation shall be supplied to the Graduate School, one bound copy and one unbound copy. The candidate is responsible for seeing to this.

6. Because of the time required to give adequate consideration to the research conducted by the student, it is imperative that the dissertation be submitted to the Dissertation Committee not later than April 15 and deposited with the Graduate School by May 20 for spring degrees.

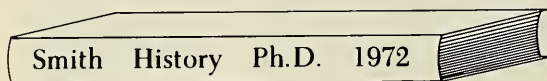
7. Although uniformity of style in dissertations is desirable, different disciplines have distinctive research and presentation styles. The following recommendations should help derive maximum uniformity:

- a. The MLA Style Sheet (2nd Edition) is the Graduate School standard. However, any school, college, or department may specify substitute standards agreed upon in that discipline.

- b. The original copy of the Ph.D. dissertation is left unbound. The second (Library) copy should be bound in black in a permanent waterproof buckram.

c. Gold lettering is required on the spine of bound dissertations. Lettering shall read down from the top in the following order: author's last name, name of the department, degree and year of degree. The name of the department may be abbreviated if necessary. Only authorized graduate program names should be part of the title on the spine.

Example:



d. All typed copies of theses or dissertations must be on quality rag paper, not less than 20-pound weight and $8\frac{1}{2} \times 11$ " in size. This paper is available at the University Store; no substitutions may be made. It is strongly recommended that all Xerox copies be on this same weight and quality paper. (This can be arranged by supplying your copy service with the correct paper in sufficient quantity.) Margins to the left shall be $1\frac{1}{2}$ inches; margins to the right, one inch.

e. Any method of reproducing duplicate copies that produces the required number of clear, neat, and permanent copies is acceptable.

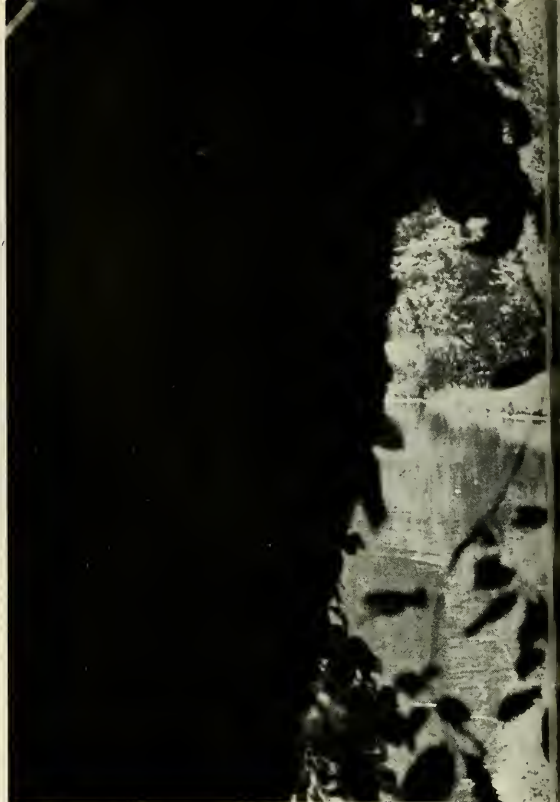
f. The form of doctoral dissertations must conform to the "Suggestions for the Preparation of Dissertations for Microfilming" which may be found in the Handbook for Graduate Faculty and Students. This booklet may be obtained in the Graduate School.

g. The title page should be arranged in this order:

1. Title.
2. Name of Author.
3. "Submitted to the Graduate School of the University of Massachusetts in partial fulfillment of the requirements for the degree of _____."
4. Degree.
5. Date (month, year).
6. Major subject.

h. Since the Graduate School has every dissertation microfilmed, much attention must be paid to the finished product. Both the Dissertation Committee and the Graduate School must approve the final format and appearance.

The candidate shall supply the Graduate School with an *unbound original* copy and one bound copy of the dissertation. The original unbound copy will be returned to the Library after being microfilmed, for binding. The candidate shall submit a money order or a certified bank



check for \$5.00 made out to the Library Binding Trust Fund. This original copy will be preserved in the central library as an archival copy. The bound copy will be located in either the central library or branch library, as appropriate, for circulation. Some departments require an additional bound copy for their own file. The candidate must also provide an abstract, in duplicate, of fewer than 600 words.

The microfilm fee of \$30 covers microfilm publication of the dissertation by University Microfilms Library Services and the publication of the abstract by them in Dissertation Abstracts.

The microfilm fee covers the cost of copyright in the author's name. If the author does not wish to have the dissertation copyrighted the microfilm fee is \$20. The dissertation will be cataloged in the Library of Congress and in the University of Massachusetts Library. Microfilm copies may be purchased from University Microfilms Library Services, Xerox Corporation, Ann Arbor, Michigan 48106. Publication by microfilm does not preclude the printing of the dissertation in whole or in part in a journal or as a monograph.



Master's Degree Requirements

In addition to the Master of Arts (M.A.) and Master of Science (M.S.) degrees, the University also offers the following master's degrees: • Master of Arts in Teaching (M.A.T.), Master of Business Administration (M.B.A.), Master of Science in Business Administration (M.S.B.A.), • Master of Education (M.Ed.), • Master of Environmental Engineering (M.Envr.E.), • Master of Fine Arts (M.F.A.), • Master of Landscape Architecture (M.L.A.), Master of Music (M.M.), • Master of Regional Planning (M.R.P.), Master of Science in Chemical Engineering (M.S.Ch.E.), Master of Science in Civil Engineering (M.S.C.E.), Master of Science in Electrical Engineering (M.S.E.E.), • Master of Science in Environmental Engineering (M.S.Envr.E.), Master of Science in Industrial Engineering and Operations Research (M.S.I.E.O.R.), Master of Science in Ocean Engineering (M.S.O.E.), Master of Science in Mechanical Engineering (M.S.M.E.), and Master of Public Administration (M.P.A.).

The basic requirements for the master's degrees are given below. Programs, asterisked

above, have additional requirements. These are listed under headings below. Also see the departmental sections for more detailed information. Refer to the *Graduate School Handbook* (copies available at the Graduate School) for further detailed guidance in the preparation through the completion of a program of study.

1. Thirty graduate credits, of which not more than six of grade B or better may be transferred from other institutions with the consent of the candidate's major Department and approval by the Graduate School. Twenty-one of the 30 credits must be in the major field. If a thesis is offered, at least six credits must be earned in 700-900 series courses; if a thesis is not offered, at least 12 credits must be earned in 700-900 series courses. Each department may permit its master's degree candidates to receive a maximum of 15 pass/fail credits. No more than 10 credits may be earned by means of a thesis. No credits remain valid after six years.

2. The thesis is optional with the school or department; if one is required, however, it shall be under the supervision of a Thesis Committee recommended by the major department. This Committee shall consist of one or more members of the Graduate Faculty appointed by the Dean of the Graduate School upon recommendation of the Head or Chairman of the Department. As soon as practicable after the student arrives on campus and prior to the appointment of a Thesis Committee, an Adviser or Guidance Committee shall be appointed from the members of the graduate Faculty. Once the candidate has selected his thesis topic, the Guidance Committee may be appointed as the Thesis Committee; these two committees are not necessarily the same, however. The thesis must be approved by the Thesis Committee, the Department Chairman, the Adviser, and any Graduate Faculty members who may be designated by the Department Chairman.

The candidate must also pass a general examination, not necessarily limited to the thesis topic, to be conducted by an Examining Committee of at least three members of the Graduate Faculty. This examination must be taken whether the student writes a thesis or not. The recommendation of two of the three members of the Examining Committee shall be requisite to receiving the degree. If the candidate prepares a thesis, Special Problem courses shall be limited to six credits; if a thesis is not prepared, nine credits of Special Problem courses may be taken.

3. Candidates for the Ph.D. degree may apply for the master's degree when they have fulfilled the residence and course requirements for the doctorate and the master's degree, have passed any applicable language examinations and have successfully completed the preliminary comprehensive examination for the Ph.D. They must also fulfill the course requirements listed under #1—Master Degree Requirements.

4. Foreign language requirements for the master's degree are optional with the school or department.

5. Course credits used for fulfilling the requirements for a master's degree may not be used for fulfilling requirements for any other master's degree at this University.

MASTER OF ARTS IN TEACHING

This is a program of at least 36 credits of which a maximum of 9 credits of grade B or better from another accredited institution may be applied toward the degree with the approval of the Graduate School.

MASTER OF EDUCATION

This is a 33-credit program in which a maximum of 9 credits of grade B or better from another accredited institution may be applied toward the degree with the consent of the School of Education and approval by the Graduate School.

MASTER OF FINE ARTS

The Master of Fine Arts degree program is administered by an interdisciplinary committee appointed jointly by the Dean of the Graduate School and the Dean of the College of Arts and Sciences. The degree is particularly designed for those interested in the creative aspects of the arts and may be obtained in the Department of Art for work in the visual arts, the Department of English for work in creative writing, or the Department of Speech for work in dramatic art. The basic requirements for the degree are:

1. Sixty credits at the graduate level. Not more than 12 credits may be transferred from other institutions where the department considers it appropriate; 12 hours should be taken in one or more of the art fields other than that of the major department. No more than 18 credits may be earned for the thesis project. No credit is valid after eight years.

2. The exact nature of the thesis project will be determined by the student's major adviser

in conference with the student. It is to be understood that the project will be productive of a work of art. A written analysis of the work itself and of the procedures used in producing it will be required. The candidate will be asked to pass an examination in his major field in addition to presenting his thesis project publicly. Applicants to the Department of Art (Studio) must submit a portfolio of slides directly to the Director of the Graduate Art Program.

MASTER OF FINE ARTS IN ART

This degree program is designed for students who are committed to becoming professional artists and who want an intensive two-year, 60-hour, in-residence preparation for careers in art. There are four principal areas of study: painting, printmaking, ceramics, and sculpture. An applicant must select and qualify in one of these areas. The thesis (required) consists of a one-man exhibition supported by a written statement and other documentation, including a slide of each work in the exhibition. The candidate must also make an oral defense of the thesis.

Thirty-six credit hours are required in the major; 12-18 of these are thesis credits. The remaining 24 hours, taken in other studio areas and art history constitute the minor. In some instances, if the department chairman approves, an interdisciplinary course of study may be arranged, providing that it is consistent with the student's background and goals. Up to 18 hours of work may be taken as special problems. This includes three hours for the New York Program, operated in conjunction with the School of Visual Arts and offered in January during the semester break.

Fall enrollment is necessary to assure continuity in the program. The number of graduate students that can be accepted into the studio-art program each Fall is limited. Often quotas are filled by March 1. Therefore, application should be made early. Only those applicants who can clearly demonstrate their ability to work at a professional level need apply. There are a few openings for qualified special students, but admission to courses is on a space available basis, as degree candidates are given preference.

The normal requirements for admission to the Graduate School apply except that applicants to the M.F.A. Art program must also submit a portfolio of slides of their work, and the Graduate Record Examination is not required.

Application forms should be obtained from and returned to the Graduate Admissions Office

by February 15. Slides should be submitted separately to the Director of the Graduate Program, Art Department, Bartlett Hall, University of Massachusetts, Amherst, Massachusetts 01002. Space is provided on the regular application form to apply for financial aid, but note that the deadline for University Fellowship applicants is February 1.

35 mm color transparencies should be submitted in 9" x 11" clear plastic viewing sheets. There must be at least 10 slides of work from the major area. In addition, slides of drawings and work closely allied to the major direction should be included. Each slide must be labeled with name of artist, date, size, and medium. Slides of rejected candidates will be returned by April 15. Slides of accepted candidates, including those on waiting list status, will be retained by the department until admission procedures have been completed.

MASTER OF FINE ARTS IN ENGLISH

This degree, based upon a 2-3 year program of 54 hours, is designed for qualified graduate students who are determined to become reputable writers of fiction, poetry or drama, and who wish to prepare themselves for the variety of positions related to the profession of writer, including the college teaching of English.

The normal standards for admission to graduate study in English apply, except that applicants for the MFA must also submit supplementary original writing in fiction, poetry or drama: two short stories, or twenty pages of fiction; from eight to twelve pages of poetry; or one full act of a play. Manuscripts should be mailed separately to the Director of the MFA Program in English, Bartlett Hall, University of Massachusetts, Amherst, Massachusetts 01002.

The candidate must either pass one foreign language examination or translate a body of work from another language. He must pass an oral examination including a defense of his thesis, which should constitute a book-length manuscript of fiction, poetry or drama, of publishable quality.

The 54 hours of work are apportioned as follows: 12 hours of courses in imaginative writing; 12 hours of thesis credit, incorporated into the course structure of the credits in imaginative writing, beginning with the second semester of such studies; 6 hours in another appropriately related department of art, comparative literature, music, speech-drama; 24 hours in American and



English literature and language, including at least two courses in the modern and contemporary genre of his specialty (fiction, poetry or drama), and one each in either modern or contemporary courses in the other two genres.

Application forms should be obtained from and returned to the Graduate School. Deadline for applications is February 15. Candidates will be notified by April 1.

MASTER OF SCIENCE IN LABOR STUDIES

The graduate curriculum leading to the Master of Science in Labor Studies is an interdepartmental one, with responsibility for coordinating students' programs vested in the interdisciplinary Committee recommended by the Advisory Council of the Labor Center and approved by the Dean of the Graduate School.

Students in this program will be individually advised by members of the Interdisciplinary Committee.

Two years is considered the normal period for completing this degree.

Students who successfully complete the graduate curriculum in Labor Studies will be prepared primarily for academic work, labor union employment, and government service.

The basic requirements for the degree are:

1. Forty-two graduate credits of which no more than nine may be transferred from other accredited institutions.

2. A thesis is optional.

3. Research project (in the first year), an internship (in the summer), and an administrative assignment in the worker's education extension teaching area (in the second year) will be expected of each candidate.

MASTER OF LANDSCAPE ARCHITECTURE AND MASTER OF REGIONAL PLANNING

The degrees are conferred upon graduate students who have satisfactorily met the following requirements:

1. Work covering at least two years in residence, and a minimum internship in a public or private office of at least three months. Specific requirements concerning the nature of such practice are determined by the department.

2. The earning of not fewer than 46 credits, of which 28 shall consist of graduate level courses within the department, with specific exceptions at the discretion of the department.

3. Preparation of a satisfactory thesis or terminal project.

4. The passing of a final examination, written and/or oral.

5. Recommendation by the Department of Landscape Architecture to the Graduate School for the awarding of the degree and approval of the recommendation by the Dean of the Graduate School.

MASTER OF SCIENCE IN ENVIRONMENTAL ENGINEERING/ MASTER OF ENVIRONMENTAL ENGINEERING

Students with baccalaureates from any of the following disciplines are eligible: engineering, physical science, natural science, social science, and public health. All candidates with non-engineering backgrounds must present satisfactory evidence of proficiency in the following: elementary differential equations, general chemistry, introductory physics, statics, fluid mechanics, and engineering hydraulics.

Each candidate must take a common core of fundamentals intended to provide a technical foundation for more advanced environmental engineering courses and an understanding of the institutions and policies common to control of water and air quality and land usage. Beyond this core, environmental engineering elective courses have been conveniently grouped into three descriptive areas—systems, design, and science—each of which includes offerings in water, air, and land resources. A total of 31 credits must be earned, 6 of which may be for a thesis. Although the general requirements of the Graduate School are the same for both degrees, the Master of Science in Environmental Engineering is conferred upon those with bachelors' degrees in engineering, while the Master of Environmental Engineering is awarded to candidates who do not hold bachelors' degrees in engineering.

Master's Thesis

The requirements for the master's thesis are the same as those for the doctoral dissertation, listed above, with the following exceptions:

1. At least five months prior to the student's anticipated date of graduation, the Chairman or Head of the Department shall submit nominations to the Graduate Dean for a Thesis Committee. This Committee may consist of one, two, or three members, all of whom must be members of the University of Massachusetts Graduate Faculty. After the Thesis Committee has been appointed by the Graduate Dean, it shall review the candidate's proposed thesis outline. When accepted, all members shall sign a cover sheet indicating approval. The thesis outline, with the cover sheet bearing the signatures of the

Committee members and the date of the Thesis Committee's meeting with the candidate, will be forwarded to the Graduate School by the Graduate Program Director.

2. A bound original and one unbound copy of the thesis are required. Both copies are to be bound in red waterproof buckram. The original copy will be preserved in the central library as an archival copy; the second copy will be located in either the central library or branch library, as appropriate for circulation. Some departments require an additional copy of the thesis for their own files.

3. The two bound copies required by the Graduate School or a bindery receipt must be submitted along with the Eligibility for Degree form to the Graduate School by the deadline for the appropriate degree granting period.

Foreign Language Examinations

Under Graduate Council policy, each academic department establishes foreign language requirements for its own advanced degree candidates. The department determines both the number of foreign languages and the level of competency required. A foreign language is defined for this requirement as a language other than the candidate's native tongue, in which there is a significant body of literature relevant to his academic discipline.

The levels of competency which a department may select are:

1. Advanced level.
2. Intermediate level.

3. Journal level: reading knowledge sufficient to understand journals in the language of the student's academic disciplines.

4. No foreign language competency.

A department may select any of these levels or any combination of them for as many languages as it wishes. When a department selects levels one or two, the student's competency will be judged by the score on the Graduate School Foreign Language Examination: The passing grade for advanced and intermediate levels will be specified by the Graduate Council. Current passing levels are 600 and 450, respectively. The results will be recorded on the student's transcript. When a department selects level three, the student's competency will be decided by a departmental committee, but not by his Thesis or Dissertation Committee, and no entry will be made on his transcript.



General Regulations

1. Course numbering system at the University of Massachusetts:

- 001-099 Noncredit courses, nonquality point courses, entrance deficiencies, etc.
- 100-199 Undergraduate credit only: lower division.
- 200-399 Undergraduate credit only: upper division.
- 400-499 Professional courses which presume a bachelor's degree.
- 500-699 Graduate credit only: parallel to 200-399.
- 700-999 For graduate students only.
 - 700 Special Problems.
 - 800 Master's Thesis.
 - 900 Doctoral Dissertation.

2. Academic average for regular standing:

A graduate student must maintain a 2.80 overall cumulative average in all graduate courses in the field of his major. A student cannot repeat such courses to raise his grade point average. He may repeat them to improve his knowledge of the subject matter. A student whose cumulative grade point average in the field of his major falls below 2.80 is placed on academic probation. If, at the end of the ensuing semester, the cumulative average remains below 2.80, he is subject to academic dismissal upon the recommendation of his major department.

3. Academic average for graduate degrees:

In the grades which a student is offering to satisfy degree requirements, a minimum standard for satisfactory work is a B average. No degree will be awarded to a student whose course work earned for the degree at the University of Massachusetts is below 3.0.

4. *Full-time students register* for eight credits or more per semester. Part-time students register for seven credits or less per semester. Ph.D. candidates may be considered full-time students regardless of the number of dissertation credits for which they register, if the major department certifies that they are working full-time on research.

5. *Withdrawal regulations:*

a.) To add, drop, or change a course, the student must obtain the written approval of the instructor concerned and his Faculty Adviser. Signed cards are to be filed with the Graduate Office.

b.) Up to and including ten academic days from the beginning of a semester a student may add, drop, or change courses without penalty. No courses may be added after this date. Signed cards are to be filed with the Graduate Office.

c.) After period (a) but within six calendar weeks beyond the beginning of a semester a student may drop courses with a grade of DR provided approval is obtained from the instructor and the student's major adviser.

d.) During periods (b) and (c) a student may withdraw from the University without academic penalty. Grades of DR will be noted on his record. After six weeks, grades of WF or WP will be entered unless special permission is obtained from the Dean of the Graduate School. No student may withdraw from courses after final examinations begin.

6. *Incompletes:*

A student can obtain credit for an "incomplete" only by finishing the work of the course before the end of one calendar year from the time of enrollment in the course (whether or not he is enrolled). At the end of that period, if a grade is not submitted, an IF (incomplete F) will be recorded. The initiative in arranging for the removal of an "incomplete" rests with the student.

7. *Candidates registering for thesis* or dissertation credits (Thesis 800 and Dissertation 900) will register for credits recommended by the Thesis or Guidance Committees. These credits will remain "incomplete" except for the semester in which the thesis or dissertation is completed, when the grade will be either S (Satisfactory) or NS (Not Satisfactory) as recommended by the Thesis or Guidance Committee.

8. *Five-college library use:*

The libraries at Amherst, Smith, Hampshire and Mount Holyoke Colleges are normally off-limits to graduate students from the University of Massachusetts. These library facilities are developed by these institutions to serve the needs of their own students. The physical facilities and the staff services

are not adequate to the additional loads imposed by outside demands.

Graduate students who have been accepted for candidacy and are working on doctoral dissertations may use these libraries by obtaining special permission from the Dean of the Graduate School. Such requests must be initiated through the Chairman of the student's Guidance Committee.

Students enrolled in Five-College Cooperative Ph.D. programs may use the various libraries when the head of the department concerned has supplied the name of the student to the Graduate Office, which will then send proper notification to the area libraries.

Students taking courses on a campus other than their own are entitled to the use of the library on that campus for the purposes of those courses only.

UNDERGRADUATES TAKING GRADUATE-LEVEL COURSES

Registration of an undergraduate in a graduate course numbered in the 400, 700, or 800 series is subject only to the permission of the course instructor. An undergraduate student who wishes to register in a graduate course numbered in the 500 or 600 series must file a specific authorization, issued by the Head of the Department offering the course, with the undergraduate Registrar.

TRANSFER OF COURSES AND CREDITS TAKEN OVER AND ABOVE CREDITS EARNED FOR A BACHELOR'S DEGREE

An undergraduate student in his senior year at any of the five-college institutions and who will earn during this year more credits than he will need for his bachelor's degree, may register concurrently for graduate credits at the University of Massachusetts if he has the permission of his major adviser and of the graduate course instructor. He registers for these credits with his undergraduate Registrar. After he has completed the courses, if he wishes to transfer them to a graduate program, his undergraduate Records Office should send to the Graduate School an official statement listing the courses, credits, and grades, and certifying that they were over and above those needed by the student for his bachelor's degree. The Graduate School will then record this information on a permanent record card and supply the student with transcripts bearing this legend:

Approval given (date) to transfer the following course(s) and credits, earned over and above credits required for the bachelor's degree, toward the master's degree.

Special Services Available to Graduate Students

GRADUATE COURSES DURING THE SUMMER

The University offers opportunity to pursue graduate studies during the summer. Details regarding courses offered, facilities for study, tuition and fees, etc., may be found in the Summer Session Bulletin, a copy of which may be obtained upon request to the Graduate Admissions Office, Graduate Research Center, around April 1.

HEALTH SERVICES

All students who have paid the Health Fee are eligible to receive care through the University Health Services. The provision of direct personal services to students is financed entirely by the student Health Fee. Therefore, any professional services rendered on campus by a member of the Health Services' staff is provided without additional charge. Off-campus hospitalization and surgical services can be arranged by the Health Services' staff, but the cost of this care is the responsibility of the individual student. A supplemental insurance program is available to students on an optional basis to provide coverage for most medical and surgical services not available at the Health Center. This plan also provides coverage for dependents of students. The purpose of the Health Services is to help each student realize optimum physical, emotional, and social well-being so he may most benefit from his University experience. Services available at the Health Center include unlimited outpatient consultation with staff physicians and nurse practitioners backed by supporting diagnostic x-ray, laboratory, pharmacy, and physical therapy facilities. In addition, the Health Center contains 65 beds for the care of students who require hospitalization.

The outpatient clinic hours are weekdays, 8:00 a.m.-12 noon and 1:00-5:00 p.m., and for urgent problems only, Saturdays, 8:00-11:30 a.m. Appointments made with the physician of choice are encouraged, but care may be obtained on a walk-in basis if the student's needs so require. Emergency care is available 24-hours-a-day, seven days a week. Should a student need to stay in the Infirmary, an attempt will be made to provide an opportunity to study if he feels able. Student visitors are allowed during specific hours; parents may visit at any reasonable hour.

The Mental Health Division, located in Machmer Hall, is available to assist students with specific emotional problems and includes diagnostic and

short-term treatment services. Appointments may be made by calling the Mental Health Division directly at 545-2337. In addition to direct-care services, the health program includes an active Health Education Division which attempts to involve students in programs that develop awareness of personal and community health needs. The Health Services is also concerned with matters of environmental health and safety that affect students, faculty, employees, and visitors on campus.

Each graduate student who has paid the Health Fee must fill out and submit a pre-entrance medical history and health evaluation form prior to registration. Information contained on this form will in no way affect the student's admission to the Graduate School. Students who have been under medical supervision prior to entrance are encouraged to have their physician contact the Health Services and provide detailed reports and instructions. In brief, the Health Services attempts to provide all students with a coordinated and comprehensive program of health supervision.

It is important to note that all health-service program records are strictly *confidential*. No information will be released without the expressed written permission of the student. Students with questions concerning their health are encouraged to speak with a member of the staff upon arrival on campus.

CAREER PLANNING & PLACEMENT SERVICE

Vocational counseling with assistance in finding employment through career and occupational information, on-campus interviews, the providing of prepared credentials, personal resumes and recommendations is offered to aid graduate students to attain their career objectives.

POST-DOCTORAL FELLOWS, RESEARCH ASSOCIATES AND VISITING SCHOLARS

Post-Doctoral Fellows and Research Associates will be entitled to faculty privileges for the duration of their appointments at the University. Qualified scholars who may desire temporarily the privileges of the library and research facilities of the University, and who are not candidates for a degree may, upon recommendation of the Dean of the Graduate School and the approval of the President, be appointed Honorary Fellows without stipend. Such Fellows will be entitled to faculty privileges.

GRADUATE STUDENT SENATE

The Graduate Student Senate serves as the representative body of graduate students at the University. It pursues policies and objectives that serve to advance the material and academic needs of the graduate community.



Description of Courses

Before consulting the course descriptions listed in this section, students should become thoroughly familiar with the General Regulations governing registration for courses in the Graduate School. The regulations (See Page 35) cover such matters as graduate credit, course numbering system, changing or dropping of courses, and requirements regarding incomplete work in a course. Students should also acquaint themselves with the requirements governing the particular degree which they wish to earn. The requirements for the various degrees are listed on Pages 27-35.

For description of courses numbered from 100 to 399, refer to the current Undergraduate Course and Faculty Directory of the University.

Agricultural and Food Economics

GRADUATE FACULTY

N. EUGENE ENGEL, *Head of Department of Agricultural and Food Economics and Professor*, B.S., Nebraska, 1954; M.S., Connecticut, 1959; Ph.D. 1967.

THOMAS M. BELL, *Assistant Professor*, B.S., Mississippi State, 1966; M.S., 1967; Ph.D., Illinois, 1969.

ROBERT S. BOND, *Associate Professor of Forestry; Forestry and Wood Technology*.

JOHN H. BRAGG, *Associate Professor*, B.S., Maine, 1948; M.S., Maine, 1949; D.B.A., Indiana University, 1966.

ROBERT L. CHRISTENSEN, *Associate Professor, Director of Graduate Studies*, B.S., Michigan State, 1958; M.S., Delaware, 1960; Ph.D., North Carolina State, 1967.

BRADFORD D. CROSSMON, *Professor*, B.S., Connecticut, 1937; M.S., 1943; M.P.A., Harvard, 1949; D.P.A., 1963.

JOHN H. FOSTER, *Professor*, B.S., Cornell, 1950; M.S., Purdue, 1951; Ph.D., Cornell, 1957.

ELMAR JARVESOO, *Associate Professor*, M.S., Tartu University, Estonia, 1937; Dr. Agri. Sci., University of Berlin, 1939.

EDWARD K. KNAPP, *Associate Professor*, B.S., Cornell, 1950; M.S. (Ed.), 1951; Ph.D., Michigan State, 1969.

THEODORE W. LEED, *Professor*, B.S., Ohio State, 1950; M.S., 1951; Ph.D. 1957.

DONALD R. MARION, *Associate Professor*, B.S., Cornell, 1954; M.S., 1955; Ph.D., Massachusetts, 1971.

BRIAN R. PAYNE, *Adjunct Assistant Professor of Forestry and Adjunct Professor of Agricultural Economics*.

SARGENT RUSSELL, *Professor*, B.S., Maine, 1937; M.S., Cornell, 1939; Ph.D., Massachusetts, 1956.

DAVID A. STOREY, *Professor*, B.S., Massachusetts, 1954; M.S., Purdue, 1958; Ph.D., Purdue, 1960.

The Department offers both the Ph.D. and the M.S. degrees. The primary objective of the graduate program in Agricultural and Food Economics is the education of applied economists to meet the needs of contemporary society in the United States and other countries. Fields of interest included in the Department's program are: 1) Natural Resource Economics (Environmental Economics), 2) International Agricultural Development Economics, and 3) Food Production and Marketing Economics.

The doctoral degree requirements of the Graduate School apply to the Ph.D. program. The student's program of study will be developed in accordance with his individual objectives and the required level of competence in economic theory and quantitative analytical methods established by the Department. The Ph.D. student is required to demonstrate research competency by completing an acceptable Ph.D. dissertation. No foreign language competency is required.

The general requirements established by the Graduate School also apply to the M.S. degree program. The M.S. degree candidate will earn from 6 to 9 credits in "experience activities" which include the alternatives of a 9-credit thesis or a 6- to 9-credit special problem in research, teaching, extension, or administration. No foreign language competency is required. A written qualifying examination normally is taken after the student completes his coursework.

ALL COURSES CARRY 3 CREDITS UNLESS OTHERWISE SPECIFIED

COURSES OPEN TO GRADUATE STUDENTS ONLY (For either major or minor credit)

700. PROBLEMS IN AGRICULTURAL, FOOD, AND RESOURCE ECONOMICS.

Independent study and research on selected problems in agricultural, food, and resource economics.

702. AGRICULTURE IN THE NATIONAL ECONOMY.

The application of economic theory, particularly welfare economics, to the determination of agricultural prices and income. The interdependency of agriculture and other sectors of the economy. Effects on agriculture of national fiscal and monetary policy. Mr. Engel.

704. ADVANCED ANALYSIS OF FOOD MARKETING SYSTEMS.

Conceptual and normative analysis at both micro- and macro-levels of food and commodity marketing systems. Firm and group behavior, market structure, public policy implications. Mr. Storey.

705. RESEARCH METHODS IN AGRICULTURAL, FOOD, AND RESOURCE ECONOMICS.

Scientific method and its application. Selection, planning,

and conduct of research. Formulation of models and hypotheses. Interdisciplinary considerations. Techniques commonly used and promising new approaches. Research administration. *Credit, 1-3.* Mr. Jarvesoo.

721. NATURAL RESOURCE DEVELOPMENT ECONOMICS.

Welfare economics in relation to resource development goals; use of economic models for resource development planning and decision making; problems of evaluating development plans.

740. QUANTITATIVE METHODS.

Applications of micro-econometric techniques in agricultural, food and resource economics. Emphasis on practical applications of modern methods of quantitative analysis to problems of the firm. *Mr. Bell.*

775. ADVANCED AGRICULTURAL AND FOOD ECONOMICS.

Intensive study of the theory of the firm as it applies to agricultural and food production, including: production functions, cost functions, programming, and decision-making principles; the nature of the aggregate supply function in agriculture; applications of these principles to the agricultural firm and regional resource allocation, and to the distribution of income to and within agriculture.

Prerequisite, permission of instructor. *Mr. Jarvesoo.*

799. SEMINAR *Credit, 1-3.*

800. MASTER'S THESIS. *Credit, 3-9.*

900. DOCTORAL DISSERTATION.

COURSES OPEN TO BOTH GRADUATE AND UNDERGRADUATE STUDENTS

(For either major or minor credit)

535. AGRICULTURAL BUSINESS MANAGEMENT. Basic decision-making principles, management tools, analytical methods and their application to management problems of commercial farms and other agricultural firms. *Mr. Leed.*

546. ADVANCED MANAGEMENT OF AGRICULTURAL FIRMS.

Application of the theory of the firm and modern decision theory to management of typical agricultural businesses. Plans for alternative firm adjustments will be analyzed using budgeting and other methods.

Mr. Crossmon.

561. FOOD MARKETING SYSTEMS.

Structure of food marketing systems. Operating principles, significant product characteristics, role of specialized marketing firms, government programs and policies.

Mr. Fitzpatrick.

565. FOOD MERCHANDISING.

Principles of merchandising food products; the nature of consumer demand for food; developing a competitive strategy including product line decisions, pricing, and retail merchandising practices; budgeting and controlling sales, expenses, and profit.

Mr. Leed.

582. WATER QUALITY ECONOMICS.

Principles for selection of welfare maximizing plans from among alternative pollution control policies and measures. Market and administrative decision making processes for pollution control.

641. PRICE THEORY AND ANALYSIS.

Elements of food and agricultural price making; demand and supply theory and methods of price analysis and forecasting; introduction to econometrics.

646. REGIONAL COMPETITION AND MARKET INTERDEPENDENCY.

Interregional competition and interdependency in agricultural factor and product markets, in the context of aggregate demand and supply by regions as affected by spatial considerations. *Mr. Christensen.*

652. AGRICULTURAL POLICY.

Analysis of farm price support programs, programs for alleviation of rural poverty, food trade and aid policies, other topical issues. *Mr. Storey.*

668. FOOD DISTRIBUTION ECONOMICS.

Economic analysis of factors, internal and external to the firm, influencing sales of food firms. Emphasis on consumer concerns, public policy, and legislation in food marketing. *Mr. Marion.*

673. RESOURCE AND CONSERVATION ECONOMICS.

Economic and institutional factors controlling land and water use. Land values, private property, social control of land use, and conservation economics. *Mr. Foster.*

676. MARINE RESOURCE DEVELOPMENT ECONOMICS.

Economic analysis of alternative plans for attainment of social goals in the development of coastal and offshore marine resources. *Mr. Storey.*

681. INTERNATIONAL AGRICULTURAL DEVELOPMENT.

Economic development of low income rural economies. Relation of agriculture to national economies. Exogenous and endogenous factors in development. *Mr. Foster.*

Animal Science

GRADUATE FACULTY

THOMAS W. FOX, *Head of the Department of Veterinary and Animal Sciences and Professor of Animal Science*, B.S., Massachusetts, 1949; M.S., 1950; Ph.D., Purdue, 1952.

J. ROBERT SMYTH, *Graduate Program Director and Professor*, B.S., Maine, 1945; M.S., Purdue, 1947; Ph.D., 1949.

DONALD L. ANDERSON, *Professor*, B.S., Massachusetts, 1950; M.S., Connecticut, 1952; Ph.D., Cornell, 1955.

DONALD L. BLACK, *Professor*, B.S., Maine, 1954; M.S., Cornell, 1957; Ph.D., 1959.

WALLACE G. BLACK, *Professor*, B.S., Wisconsin, 1948; M.S., 1949; Ph.D., 1952.

ANTHONY BORTON, *Associate Professor*, A.B., Haverford 1955; M.S., Michigan State, 1961; Ph.D., 1964.

RICHARD A. DAMON, *Professor*, B.S., Massachusetts, 1947; M.S., Minnesota, 1949; Ph.D., 1951.

ROBERT T. DUBY, *Assistant Professor*, B.S., Massachusetts, 1962; M.S., 1965; Ph.D., 1967.

HEINRICH FENNER, *Associate Professor*, B.S., Agricultural College of Stuttgart-Hohenheim, 1951; Ph.D., 1956.

STANLEY N. GAUNT, *Professor*, B.S., Rutgers, 1938; Ph.D., North Carolina State, 1955.

GEORGE R. HOWE, *Associate Professor*, B.S., Vermont, 1957; M.S., Pennsylvania State, 1959; Ph.D., Massachusetts, 1961.

SIDNEY J. LYFORD, *Assistant Professor*, B.S., New Hampshire, 1958; M.S., North Carolina State, 1960; Ph.D., 1964.

WILLIAM J. MELLEN, *Professor*, B.S., Massachusetts, 1949; M.S., Cornell, 1951; Ph.D., 1953.

MARTIN SEVOIAN, *Professor of Veterinary Science*, B.S., Massachusetts, 1949; V.M.D., Pennsylvania, 1953; M.S., Cornell, 1954.

RUSSELL E. SMITH, *Professor of Veterinary Science*, B.S., Massachusetts, 1938; V.M.D., Pennsylvania, 1942.

GLENN H. SNOEYENBOS, *Professor of Veterinary Science*, D.V.M., Michigan State, 1945.

OLGA M. WEINACK, *Assistant Professor of Veterinary Science*, B.A., Mount Holyoke, 1946; M.S., Massachusetts, 1950.

The graduate program in the animal sciences includes studies in mammalian and avian biology, with options in (a) genetics, (b) physiology, (c) nutrition, and (d) animal diseases. Students planning to major in any one of these fields must have a strong background in biology and chemistry or mathematics, or must be prepared to remedy undergraduate deficiencies without graduate credit. The option in animal diseases is designed primarily for veterinarians but is open to others with appropriate academic training. Requirements for both the M.S. and Ph.D. degrees include courses in the animal sciences offered by the department and courses in supporting areas offered by such departments as Zoology, Chemistry, Biochemistry, Microbiology, and Statistics. Available research material includes a number of domestic species. The department requires no foreign language reading competency for the doctoral degree.

COURSES OFFERED BY THE DEPARTMENT
(Note: 500 and 600 series courses are open to both graduate and undergraduate students; 700 and 800 series are open to graduate students only. Where prerequisites are stated, equivalent courses taken at other institutions or permission of instructor may be substituted.)

ALL COURSES CARRY 3 CREDITS UNLESS OTHERWISE SPECIFIED

Genetics

608. COMPARATIVE ANIMAL GENETICS.

The mechanisms of heredity and variation in livestock and poultry; the role of selection and breeding systems in genetic improvement and their evaluation.
Prerequisite, Zool 540. Mr. Fox.

704. AVIAN GENETICS.

The classical and physiological genetics of morphological traits of avian species. Emphasis on melanogenesis and characteristics involving epidermal structures.

Prerequisites, one year's training in biology and Zool 540.
Mr. Smyth.

705. GENETICS OF PRODUCTIVE TRAITS IN POULTRY.

Lectures and reports on the genetics of meat production and reproduction. Emphasis on the physiological genetics of fertility and embryogenesis.

Prerequisites, one year's training in biology and Zool 540.
Mr. Smyth.

706. QUANTITATIVE INHERITANCE AND SELECTION.

The principles of population genetics and quantitative inheritance as applied to selection for traits of economic importance in poultry; theoretical and practical considerations of breeding systems.

Prerequisites, An Sci 705, or Zool 540; Stat 551.

Mr. Fox.

707. ADVANCED ANIMAL GENETICS.

Modern research in animal breeding with emphasis on the statistical approach. Includes development of selection indexes for various farm animals, sire indexes, and breeding plans based on systems of mating and selection.
Prerequisite, An Sci 608. Mr. Gaunt.

Physiology

519. INTRODUCTORY ANIMAL PHYSIOLOGY.

Foundations for systemic organ physiology through the presentation of homeostatic circuits available to the living body, such as fluid, gaseous, neural, muscular, and specialized integrated mechanisms.

Two 1-hour lectures and one 2-hour laboratory period.

Mr. Howe.

520. ANIMAL PHYSIOLOGY.

Comparative study of the physiology of mammals and birds, with emphasis on those aspects most pertinent to animal science.

Prerequisite, Zool 135.

Credit, 4. Mr. Howe.

621. PHYSIOLOGY OF REPRODUCTION.

Comparative aspects of anatomy, embryology, endocrinology, and physiology of reproduction and lactation.

Credit, 4. Mr. W. G. Black.

724. ADVANCED AVIAN PHYSIOLOGY.

Lectures and reports on specific problems in avian physiology.

Prerequisites, Biochem 524, An Sci 520.

Mr. Anderson, Mr. Smyth.

725. MAMMALIAN REPRODUCTION.

An advanced course emphasizing the comparative approach to problems of reproductive anatomy and endocrinology. Lectures, laboratory and seminar reports with theoretical and practical consideration of current research findings in laboratory and domestic animals and in primates.

Mr. D. L. Black.

726. FERTILITY AND FECUNDITY.

The role of heredity, nutrition, pathology, and environment in the determination of fertility and fecundity in mammalian forms. Current research directed toward control of reproductive function through experimental means is emphasized.

Prerequisites, An Sci 621 or 725. Mr. W. G. Black.

Nutrition

630. PRINCIPLES OF NUTRITION.

Scientific principles of nutrition, emphasizing the basic biochemical and physiological concepts underlying the specific functions and interrelationships of the nutrients required for maintenance, production, and reproduction in both ruminants and nonruminants. Mr. Anderson.

734. **ADVANCED AVIAN NUTRITION.**
Lectures, reports, and discussions of significant research developments and theories in avian nutrition.
Prerequisites, Chem 562, Biochem 524, An Sci 630.
Mr. Anderson.

735. **RUMINANT NUTRITION.**
An advanced course in ruminant digestion and metabolism. Special topics selected and discussed in the light of recent and current research.
Prerequisites, An Sci 630, Biochem 524.
Mr. Fenner, Mr. Lyford.

Animal Diseases.

(Students holding a medical degree will not be given credit for the following Animal Science courses: 670, Animal Pathology; 772, Mammalian Diseases; 773, Avian Diseases; and 774, Histopathology.)

670. **ANIMAL PATHOLOGY.**
Introduction to the study of animal diseases; causes, development, transmission, and control. Lectures and demonstrations.
Prerequisite, permission of instructor.

Credit, 3. Mr. Smith.
771. **DIAGNOSTIC LABORATORY TECHNIQUES.**
Microbiological, histopathological, immunological, hematological techniques applicable to the diagnostic laboratory.
Credit, 2. Graduate Staff.

772. **MAMMALIAN DISEASES.**
A survey of diseases of mammals, including laboratory animals. Emphasis on infectious diseases and their control. Lectures and demonstrations.
Prerequisite, permission of instructor. Mr. Harris.

773. **AVIAN DISEASES.**
A survey of avian diseases. Emphasis on infectious diseases and their control. Lectures and demonstrations.
Prerequisite, permission of instructor. Mr. Snoeyenbos.

774. **HISTOPATHOLOGY.**
Histological study of basic pathological processes.
Prerequisite, permission of instructor. Mr. Sevoian.

Miscellaneous

661. (I). **INTERMEDIATE BIOMETRY.**
Design of experiments in the biological sciences. Methods of analysis of such designs, including expectations of mean squares, selection of appropriate error terms, individual and multiple comparisons, and trend analyses.
Prerequisite, introductory course in biometrics or statistics, such as Stat 121.
Mr. Damon.

662 (II). **ADVANCED BIOMETRY.**
Analysis of data with disproportionate subclass numbers, including the method of fitting constants, the method of weighted squares of means, absorption of equations, expectations of mean squares, and tests of hypotheses.
Prerequisite, An Sci 661.
Mr. Damon.

700. **SPECIAL PROBLEMS.**
A specific problem in some aspect of animal science not related to the candidate's thesis.
Credit, 3-6.

751, 752. **SEMINAR.** Credit, 1 each semester.

Anthropology

GRADUATE FACULTY

RICHARD B. WOODBURY, *Chairman of the Department of Anthropology and Professor, B.S., Harvard, 1939; M.A., 1942; Ph.D., 1949.*

GEORGE J. ARMELAGOS, *Assistant Professor, B.A., Michigan, 1958; M.A., Colorado, 1963; Ph.D., 1968.*

JOHN W. COLE, *Assistant Professor, B.A., Michigan, 1957; M.A., 1963; Ph.D., 1969.*

JOHNETTA B. COLE, *Assistant Professor, B.A., Oberlin College at Ohio, 1957; M.A., Northwestern Univ., 1959; Ph.D., 1967.*

RALPH H. FAULKINGHAM, *Assistant Professor, B.A., Wheaton College, 1965; M.A., Michigan State, 1969; Ph.D., 1970.*

SYLVIA HELEN FORMAN, *Assistant Professor, B.A., Univ. of California at Berkeley, 1968; M.A., 1969; Ph.D., 1972.*

DAVID H. FORTIER, *Assistant Professor, B.A., Columbia, 1949; M.A., 1953; Ph.D., 1964.*

THOMAS M. FRASER, JR., *Professor, A.B., Harvard, 1949; M.A., Columbia, 1958; Ph.D., 1963.*

JOEL M. HALPERN, *Professor, B.A., Michigan, 1950; Ph.D., Columbia, 1956.*

ALFRED BACON HUDSON, *Associate Professor, B.A., California at Berkeley, 1958; Ph.D., 1967.*

DANIEL W. INGERSOLL, JR., *Assistant Professor, A.B., Harvard, 1966; Ph.D., 1970.*

MARY ELLEN MORBECK, *Assistant Professor, B.A., Univ. of Colorado, 1967; M.A., California at Berkeley, 1970, Ph.D., 1972.*

NANCY D. MUNN, *Associate Professor, B.A., Oklahoma Univ., 1951; M.A., Indiana, 1955; Ph.D., Australian National Univ., 1961.*

ORIOLE PI-SUNYER, *Associate Professor, B.A., Mexico City College, 1954; M.A., Harvard, 1957; Ph.D., 1962.*

DONALD A. PROULX, *Associate Professor, B.S., Wisconsin at Milwaukee, 1961; Ph.D., California at Berkeley, 1965.*

ZDENEK SALZMANN, *Associate Professor, M.A., Indiana, 1949; Ph.D., 1963.*

H. MARTIN WOBST, *Assistant Professor, B.A., Michigan, 1966. M.A., 1968; Ph.D., 1971.*

PETER L. WORKMAN, *Associate Professor, B.A., California at Davis, 1957; Ph.D., 1962.*

Students beginning graduate work in anthropology are expected to be conversant with the field of anthropology as evidenced by successful undergraduate completion of introductory course work in at least three of the four subfields of anthropology, plus at least two advanced courses. With respect to this requirement, an entering student will be expected to remove any deficiencies before being granted full graduate standing.

Students working toward the Master of Arts degree in anthropology, in addition to fulfilling the general requirements of the Graduate School for the degree, must achieve a mastery of general theory in cultural and social anthropology and begin developing an area or subfield of specialization. They should also attain familiarity with descriptive linguistics, physical anthropology, and archaeology.

In addition, students must pass an examination in a foreign language (or "tool of research") and a master's-level comprehensive examination in anthropology.

In addition to fulfilling general requirements of the Graduate School for the Ph.D. degree, students will be expected to pass with a grade of B or better thirty hours of course work beyond the master's degree. There are no specific requirements. Fieldwork will be required of all candidates. It should normally be undertaken under the supervision of the candidate's major adviser. This fieldwork is expected to provide the material for the candidate's doctoral dissertation.

Ph.D. candidates are required to demonstrate their proficiency in two "tools of research." Ordinarily, one of these will be a foreign language. However, each student's specific fulfillment of this requirement will be determined by consultation with his guidance committee.

ALL COURSES CARRY 3 CREDITS UNLESS OTHERWISE SPECIFIED

COURSES OPEN TO GRADUATE STUDENTS ONLY (For either major or minor credit)

700. SPECIAL PROBLEMS IN ANTHROPOLOGY.
Directed individual research or reading in anthropology.
Credit, 1-9.

701, 702. SEMINAR.
Each semester a topic is selected from one or more of the four fields of anthropology, or pertaining to anthropology as a whole. Guest speakers present their research findings to graduate students and faculty in the seminar's context.
Credit, 1 each semester.

722. ARCHAEOLOGY OF THE SOUTHWEST.
Examination of selected problems in methodology and interpretation of the prehistory of the American Southwest. May be repeated once for credit. Mr. Woodbury.

725. ANDEAN ARCHAEOLOGY.
Selected problems in excavation, analysis, and interpretation of Andean prehistory. Emphasis on the later stages of development of native American civilizations.
Mr. Proulx.

760. SEMINAR IN EUROPEAN ANTHROPOLOGY.
Particular attention to problems resulting from students' field investigations in Europe.

765. PROBLEMS IN FAR EASTERN ANTHROPOLOGY.
Detailed consideration of selected, important anthropological problems and controversies in dealing with cultural and anthropological data from the Far East. China is emphasized.
Mr. Fortier.

767. SOUTHEAST ASIAN ANTHROPOLOGY.
Selected problems in Southeast Asian anthropology, such as relations between hill and valley cultures, education, economic development, and minority group problems. Major attention to the mainland.
Mr. Fraser, Mr. Halpern.

770. PROBLEMS IN NORTH AMERICAN ARCHAEOLOGY.
Selected problems in North American archaeology, emphasizing the anthropological interpretation of prehistoric data.
Mr. Ingersoll.

802. RESEARCH IN ARCHAEOLOGY.
Directed individual research in archaeology.
Credit, 1-12.

803. RESEARCH IN PHYSICAL ANTHROPOLOGY.
Directed individual research in physical anthropology.
Credit, 1-12.

804. RESEARCH IN CULTURAL ANTHROPOLOGY.
Directed individual research in cultural anthropology.
Credit, 1-12.

805. RESEARCH IN LINGUISTIC ANTHROPOLOGY.
Directed individual research in linguistic anthropology.
Credit, 1-12.

812. SEMINAR IN SOCIAL BIOLOGY.
The interaction of the social, biological, and ecological factors involved in various aspects of human biological and cultural diversity.
Mr. Workman.

836. INDIVIDUAL AND SOCIETY.
A cross-cultural consideration of the relationship between the individual and his society with attention to theories, methods, and empirical findings as reported in the literature of the behavioral sciences.

837. THE HISTORY OF ANTHROPOLOGICAL THEORY.
The origin and development of anthropological theory, cultural evolution, culture history, and cultural dynamics with a primary focus on trends in American anthropology up to mid-twentieth century.
Mr. Fortier.

840. ANTHROPOLOGY AND DEVELOPMENT
Tribal and traditional economic systems and the process of economic technological change. Emphasis on current problems of modernizing nations.
Mr. Pi-Sunyer.

841, 842. THEORY AND METHOD IN SOCIAL ANTHROPOLOGY.
A two-semester sequence devoted to structural functional analysis as developed in British social anthropology. Emphasis on method in the analysis of social and political theoretical issues.
Credit, 6 (3 each). Miss Munn, Mr. Faulkingham.

845. REVOLUTION AND SOCIAL CHANGE.
Drastic social and cultural change. Emphasis on the historical background and social contexts of political revolutions and their role in modernizing nations.
Mr. Halpern.

850. SEMINAR IN COMPARATIVE SYMBOL SYSTEMS.
Current theory and analytic method in the symbolic analysis of socio-cultural systems.
Miss Munn.

860. LANGUAGE AND CULTURE.
Linguistic prehistory and classification; methods and interpretations of comparative linguistic analysis; linguistic methodology and "ethnoscience" approaches; the "Whorf hypothesis" and linguistic relativity.
Mr. Hudson.

861. ANTHROPOLOGY OF COMMUNICATION.
Various communicative codes, from a biological and socio-cultural viewpoint.
Mr. Salzmann.

875. METHOD IN CULTURAL ANTHROPOLOGY.
Methods of studying cultures of homogeneous and heterogeneous societies among primitive and modern peoples, with emphasis on the various techniques of field work; observation, interviewing, use of technical devices, content analysis, and projective and verbal materials.

880. PHYSICAL ANTHROPOLOGY: THE SKELETON.
The human skeleton considered in its functional aspects and with reference to evolution, age, and sex. Methods of osteological investigation and osteometrics.
Mr. Armelagos.

882. PHYSICAL ANTHROPOLOGY OF THE LIVING. Techniques and applications of physical anthropology among living persons. Anthropometry, somatotyping, serology, and other descriptive methods; elements of statistical analysis. Body form and function in relation to individual constitution and racial variation.

Mr. Armelagos.
Credit, 30.

900. DOCTORAL DISSERTATION.

ANTHROPOLOGY COURSES OPEN TO BOTH GRADUATE AND UNDERGRADUATE STUDENTS. (For either major or minor credit)

555. PRE-INDUSTRIAL TECHNOLOGY.

Analysis of selected aspects of the material culture of simpler societies, past and present, in relation to social and economic aspects of culture.

Mr. Woodbury.

560. PEOPLES OF EUROPE: EASTERN EUROPE AND THE U.S.S.R.

A survey of the peoples and cultures of Eastern Europe; emphasis on the Slavic peoples as well as upon those cultures transitional between Europe, the Middle East, and Asia from their prehistoric origins to the period of their modernization, stressing the role of peasantry and nomads with their changing ecological adaptations.

Mr. Halpern.

563. URBAN ANTHROPOLOGY.

Using as a point of departure the current urban condition, the origins and evolution of cities are explored in a cross-cultural framework. Emphasis on rural-urban relationships and how these have changed over time.

Mr. Halpern.

565. PEOPLES OF EUROPE: CENTRAL EUROPE. Anthropologically oriented examination of the culture of Central Europe, with emphasis on Czech culture.

Mr. Salzmann.

567. PEOPLES OF EUROPE: ALPINE EUROPE.

Analysis of Alpine cultures from prehistoric through contemporary times. Cultural adaptation to environmental variations in mountainous zones and the interrelationship of mountain and lowland communities is emphasized.

Mr. Cole.

569. CULTURES OF AUSTRALIA AND NEW GUINEA.

The ethnography of aboriginal Australia and New Guinea with emphasis on the particular problems of theory and analysis encountered in these areas.

Miss Munn.

615. PRIMATE ANATOMY.

Structure and phylogeny of primates (prosimian, monkey, and ape) with emphasis on evolutionary trends leading to man. Laboratory work provides experience in dissection.

Miss Morbeck.

620. ECONOMIC ANTHROPOLOGY.

A survey of patterns of production, distribution, and consumption in nonindustrial societies as well as of the social and political matrices of these patterns. Alternative theoretical approaches to selected problems in economic anthropology.

Mr. Cole.

621. PREHISTORIC CULTURAL ECOLOGY.

Analysis of cultural ecology approaches to the interpretation of the prehistoric record. Prerequisite, permission of instructor.

Mr. Wobst.

630. SOCIAL ORGANIZATION OF IMPERIALISM.

Analysis of the varieties of social relations between industrial societies and non-industrial areas of the world. The development of Western imperialism in Africa, Asia and the Western Hemisphere, and the patterns of resistance, accommodation, and rebellion that have developed in response.

Mr. Cole.

635. NATIVE AMERICAN LANGUAGES.

A survey of American Indian languages primarily north of Mexico. Genetic classifications and Sapir's classification based on structural resemblances between language families. Types of linguistic structure and structural restatements. Comparative work and reconstructions.

Mr. Salzmann.

640. ANTHROPOLOGICAL PERSPECTIVES ON RELIGION, RITUAL, AND MYTH.

An introductory course stressing the relationship between symbolic forms and social order, and the analysis of meaning in ritual and myth. Selected theorists from Durkheim to Victor Turner and Levi-Strauss.

Miss Munn.

662. ORAL FOLKLORE IN NONLITERATE SOCIETIES.

Introduction to the ethnography of oral folklore. Topical emphasis on the analysis and function of tales; geographic emphasis on Africa and North America.

Mr. Salzmann.

663. LINGUISTIC ANTHROPOLOGY:

THE COMPARATIVE DIMENSION.

The methods and interpretation of comparative linguistic analysis in the field of anthropology.

Prerequisite, Anthro 105 or permission of instructor.

Mr. Hudson.

664. PROBLEMS IN ANTHROPOLOGY.

Current anthropological thought in regard to specific problems chosen from physical anthropology, archaeology, and cultural anthropology.

Prerequisite, permission of instructor.

Mr. Fraser.

667. ETHNOLOGY OF AFRICA.

An intensive consideration of several representative peoples of Africa; comparison of their traditional institutions, their appearance in evolutionary and historical perspectives, and adaptations to colonialism and neo-colonialism.

Prerequisite, permission of instructor. Mr. Faulkingham.

668. OLD WORLD PREHISTORY.

The Old World prehistoric record discussed in terms of general cultural processes, and with the help of hypotheses, models, and theories developed by anthropologists and scientists.

Prerequisite, Anthro 102 or permission of instructor.

Mr. Wobst.

669. NORTH AMERICAN ARCHAEOLOGY.

An intensive survey of American Indian prehistory north of Mexico. Emphasizes the historical developmental processes in selected geographical regions.

Prerequisite, Anthro 102 or permission of instructor.

Mr. Woodbury.

670. NORTH AMERICAN INDIANS.

Indian tribes with various levels of technological development and social complexity, from areas north of Mexico, in terms of their environmental context and the impact of non-Indian societies on their cultures.

Prerequisite, Anthro 104.

Mr. Ingersoll.

672. HUMAN VARIATION.

Description and analysis of qualitative and quantitative biological variation and variation between human populations.

Mr. Workman.

673. PEOPLES OF SOUTHEAST ASIA.

An introduction to the history and ethnography of the cultures of Southeast Asia; the peasant populations and their expanding role in the development of modern Southeast Asian states.

Prerequisite, Anthro 104.

Mr. Fraser.

674. CULTURES OF THE FAR EAST.

A survey of the culture-history and ethnography of representative peoples of East Asia; peasant subcultures of traditional and contemporary China, Japan, and Korea.

Prerequisite, permission of instructor. Mr. Fortier.

675. SOUTH AMERICAN ARCHAEOLOGY.
A survey of the pre-Columbian cultures of South America and their development. Emphasis on the Andean areas.

Prerequisite, Anthro 102 or permission of instructor.
Mr. Proulx.

676. THE ETHNOLOGY OF SOUTH AMERICA.
Analysis of the prehistoric, colonial, and contemporary cultures of South America; the Indian, European, and Negro peoples and how they have related to each other over the past three centuries.

Prerequisite, Anthro 104 or permission of instructor.
Mr. Proulx.

677. SUMMER FIELD SCHOOL
IN ARCHAEOLOGY.

Practical training in archaeology. Prehistoric and Colonial sites will be excavated and instruction given in archaeological methods and techniques.

Prerequisite, Anthro 102 or equivalent.
Credit, 6. Mr. Ingersoll.

679. CULTURAL DYNAMICS AND APPLIED
ANTHROPOLOGY.

Theories of cultural process and their application to practical cross-cultural situations in administration, technical assistance, and community development.

Prerequisite, Anthro 102 or permission of instructor.
Mr. Fraser.

680. FIELD COURSE IN CULTURAL
ANTHROPOLOGY.

A summer field course for advanced undergraduates or graduates. Supervised training in cultural anthropological research. Location varies from year to year. Credit, 6.

Art

GRADUATE FACULTY

GEORGE WARDLAW—Painter—*Chairman of Department of Art and Professor*, B.F.A., Memphis Academy of Arts, 1951; M.F.A., University of Mississippi, 1954.

FREDERICK BECKER—Printmaker—*Professor*, Otis Art Institute, Los Angeles; Diploma, Beaux Arts Institute of Design, N.Y.C., 1936. Guggenheim Fellowship, 1957.

JACK L. BENSON—Archaeologist, Art Historian—*Professor*, B.A., University of Missouri, 1941; M.A., University of Indiana, 1947; Ph.D., University of Basel, 1952.

PAUL E. BERUBE—Ceramist—*Associate Professor and Director of Undergraduate Programs in Art*, B.A., Bowdoin College, 1959; B.F.A., Rhode Island School of Design, 1961; M.F.A., University of Southern California, 1962.

IRIS H. CHENEY—Art Historian—*Associate Professor*, B.A., Wellesley, 1950; M.A., 1951; Ph.D., Institute of Fine Arts, N.Y.U., 1963.

JOHN J. COUGHLIN—Printmaker—*Associate Professor*, B.F.A., Rhode Island School of Design, 1954; M.S., 1961.

HANLYN DAVIES—Painter—*Assistant Professor*, N.D.D., Swansea College of Art and University of Wales, 1963; A.T.D., 1964; M.F.A., Yale University, 1966.

WALTER B. DENNY—Art Historian—*Assistant Professor*, B.A., Oberlin College, 1964; M.A., Harvard University, 1964; Ph.D., 1970.

ELEANOR DUBE—Painter—*Assistant Professor*, B.F.A., School of Art Institute, Chicago, 1968; M.F.A., Yale University, 1970.

LEONEL GONGORA—Painter—*Assistant Professor*, Diploma in Art, Washington University, 1956.

JOHN GRILLO—Painter—*Associate Professor*, Hartford School of Fine Arts, 1935–38; Studied with Hans Hoffman, 1948–51.

JAMES P. HENDRICKS—Painter—*Assistant Professor*, B.A., University of Arkansas, 1962; M.F.A., State University of Iowa, 1964.

WALTER KAMYS—Painter—*Professor and Director, Art Acquisition Program*, Diploma in Art, Chicago Art Institute, 1943.

JERRY KEARNS—Sculptor—*Assistant Professor*, B.A., University of California, Santa Barbara, 1966; M.F.A., 1968

ROBERT W. MALLARY—Sculptor—*Professor*, Guggenheim Fellowship, 1964–65.

DONALD R. MATHESON—Printmaker—*Associate Professor and Associate Chairman of Department*, B.S., United States Military Academy, 1938; M.A., University of Michigan, 1951.

PAUL F. NORTON—Art Historian—*Professor*, B.A., Oberlin College, 1938; M.F.A., Princeton University, 1947; Ph.D., 1952.

SUSAN E. PARKS—Ceramist—*Assistant Professor*, B.A., Mount Holyoke College, 1964; M.F.A., University of Massachusetts, 1968.

WILLIAM J. PATTERSON—Printmaker—*Assistant Professor*, B.F.A., Hartford Art School of the University of Hartford, 1964; M.F.A., Syracuse University School of Art, 1969.

LYLE N. PERKINS—Ceramist—*Professor*, B.F.A., Alfred University, 1939; M.F.A., 1947; Ph.D., Ohio State University, 1956.

CARLETON L. REED—Art Educator—*Professor*, B.S., New York University, 1941; M.A., Columbia University, 1954; D.Ed., New York University, 1964.

MARK W. ROSKILL—Art Historian—*Associate Professor*, B.A., Trinity College, Cambridge, 1956; M.A., Harvard University, 1957; M.F.A., Princeton University; Ph.D., 1961.

JOHN A. ROY—Painter—*Associate Professor*, B.F.A., Yale University, 1957; M.F.A., 1959.

DALE D. SCHLEAPPI—Sculptor—*Associate Professor*, B.A., Pratt Institute, 1959; M.S., 1960.

NANCY SMITH—Art Educator—*Assistant Professor*, B.A., Bennington College, 1951; M.A., 1958; D.Ed., Harvard Graduate School in Education, 1972.

GARY TARR—Art Historian—*Assistant Professor*, B.A., University of Southern California at Los Angeles, 1963; M.A., 1966; Ph.D., 1969.

JOHN F. TOWNSEND—Sculptor—*Associate Professor*, B.S., Carroll College, 1951; M.F.A., University of Minnesota, 1959.

HUI-MING WANG—Painter—*Associate Professor*, B.S., University of Missouri, 1949; M.A., New York University, 1953.

RONALD V. WIEDENHOEFT—Art Historian—*Assistant Professor*, B.C.E., Cornell University, 1959; M.A., University of Wisconsin, 1964; Ph.D., Columbia University, 1970.

JAMES L. WOZNIAK—Ceramist—*Associate Professor*, B.S., University of Wisconsin, 1954; M.S., 1955; M.F.A., 1958.

The degree of Master of Fine Arts is offered for those interested in the creative aspects of the arts. Requirements for the degree are listed on page 00. The degree of Master of Arts in Art History is offered upon the successful completion of 30 credits and a written examination. Some courses may be taken for graduate credit at Amherst, Hampshire, Mount Holyoke, and Smith Colleges. Most students require two years to complete the degree. For further information write to Director of Graduate Studies in Art History, Art Department, Bartlett Hall, University of Massachusetts, Amherst, Massachusetts 01002.

ALL COURSES CARRY 3 CREDITS UNLESS OTHERWISE SPECIFIED

COURSES OPEN TO GRADUATE STUDENTS ONLY (For either major or minor credit)

Creative Art

700. SPECIAL PROBLEMS. *Credit, 3-12.*
701. SPECIAL PROBLEMS: PAINTING. *Credit, 3-12.*
702. SPECIAL PROBLEMS: PRINTMAKING. *Credit, 3-12.*
703. SPECIAL PROBLEMS: SCULPTURE. *Credit, 3-12.*
704. SPECIAL PROBLEMS: CERAMICS. *Credit, 3-12.*
705. SPECIAL PROBLEMS: DRAWING. *Credit, 3-12.*
711. PAINTING. *Credit, 3-12.* Mr. Wang.
721. PRINTMAKING. *Credit, 3-12.* Mr. Matheson.
731. SCULPTURE. *Credit, 3-12.* Mr. Mallary.
741. CERAMICS. *Credit, 3-12.* Mr. Berube.
800. MASTER'S THESIS. *Credit, up to 18.*

History of Art

706. SPECIAL PROBLEMS: ART HISTORY. *Credit, 3-12.*
714. GREEK PAINTING. Mr. Benson.
715. ROMAN PAINTING. Mr. Benson.
724. PROBLEMS IN ART OF THE ITALIAN EARLY RENAISSANCE AND THE NORTH EUROPEAN LATE MIDDLE AGES. Mrs. Cheney.
725. PROBLEMS IN ART OF THE HIGH RENAISSANCE TO THE EARLY BAROQUE.
727. STUDIES IN MEDIEVAL ICONOGRAPHY.

734. NINETEENTH-CENTURY PAINTING & SCULPTURE. Mr. Roskill.
735. ART SINCE 1880. Mr. Roskill.
736. NINETEENTH-CENTURY AMERICAN ARCHITECTURE. Mr. Norton.
793. SEMINAR IN TWENTIETH-CENTURY ARCHITECTURE. Mr. Wiedenhoeft.

COURSES OPEN TO BOTH GRADUATE AND UNDERGRADUATE STUDENTS (For either major or minor credit)

Creative Art

520. PAINTING I.
Easel painting in oil and related media, based on elementary understanding of physical properties of medium, and encouraging individual directions within limitations of sound composition.
Six studio hours. Mr. Hendricks, Mr. Grillo.
522. PAINTING II.
Initial concentration on transparent water color, emphasizing control of techniques and mastery of color relationships. Further experience with opaque water color, such as gouache, casein.
Six studio hours. Miss Dube, Mr. Wang.
524. PAINTING III.
Continuation of Art 520.
Six studio hours. Mr. Kamys.
530. ADVANCED DRAWING.
Investigation and development of various techniques and media. Emphasis on figure drawing.
Six studio hours. Mr. Grillo, Mr. Gongora, Mr. Kamys.
532. ADVANCED DRAWING PROBLEMS.
Advanced work in traditional and contemporary drawing media. Independent exploration of graphic problems. Solutions to problems sought in relation to student's personal objectives.
Six studio hours. Mr. Grillo.
540. PRINTMAKING: RELIEF I.
Techniques and aesthetic considerations of the wood-block print and related media. Emphasis on drawing and on understanding technical procedures.
Six studio hours. Mr. Becker.
542. PRINTMAKING: INTAGLIO I.
Techniques and aesthetic considerations of etching, engraving, aquatint, and related media. Emphasis on drawing and on understanding technical procedures.
Six studio hours. Mr. Patterson.
544. PRINTMAKING: LITHOGRAPHY I.
Techniques and aesthetic considerations of making lithographs. Emphasis on drawing and on understanding technical procedures.
Six studio hours. Mr. Matheson.
546. PRINTMAKING: RELIEF II.
Advanced study of materials, techniques, and esthetic considerations relevant to relief printmaking.
Six studio hours. Mr. Becker.
548. ART EDUCATION: METHODS AND MATERIALS I.
Methods, tools, and materials used in the public school art program, with special emphasis on the elementary school level. Required for art education majors and a prerequisite for student teaching.
Six studio hours. Miss Smith.

550. ART EDUCATION: METHODS AND MATERIALS II.

The literature, philosophies, procedures, and methods used in the teaching of art. Emphasis on the secondary school program. Required for art education majors and a prerequisite for student teaching. Mr. Reed.

554. TYPOGRAPHY I.

A studio course in typography and book design. The student selects a text, sets it in type, prints and binds at least one copy of the finished book. Six studio hours.

560. SCULPTURE I.

Experimentation with materials. Investigation into the nature of three-dimensional order. Individual projects. Six studio hours. Mr. Townsend, Mr. Schleappi.

562. SCULPTURE II.

Continuation of Art 560. Six studio hours.

Mr. Kearns.

580. CERAMICS I.

The designing and making of pottery with the potter's wheel and related tools. One or more basic courses in creative art should be taken previously. Six studio hours. Mr. Berube, Miss Parks, Mr. Wozniak.

582. CERAMICS II.

Continuation of Art 580.

Prerequisite, Art 580.

Six studio hours.

Miss Parks, Mr. Wozniak.

588. GLASS BLOWING I.

An introduction to the principles and techniques of glass blowing from molten mixes, emphasizing experimental form.

Six studio hours.

Mr. Perkins.

590. LIGHT WORKSHOP.

Introduction to the use of light as a medium of aesthetic expression. Emphasis on individual investigation into the techniques of modifying the quality of illumination. Six studio hours.

640. PRINTMAKING: INTAGLIO II.

Advanced study of materials, techniques, and aesthetic considerations relevant to etching, engraving and aquatint.

Six studio hours.

Mr. Patterson.

642. PRINTMAKING: LITHOGRAPHY II.

Advanced study of lithography. Emphasis on the concepts and techniques of color lithography. Six studio hours.

Mr. Matheson.

History of Art

505. GREEK ART.

The sculpture, painting, and architecture of ancient Greece from Protogeometric beginnings through the Hellenistic period.

Mr. Benson.

525. EARLY MEDIEVAL ART.

Early Christian art and the beginnings of Byzantine art in East and West; Coptic art, Barbarian and Celtic influences in northern Europe; Carolingian, Ottonian, and Anglo-Saxon art.

527. ART OF THE ROMANESQUE AND GOTHIC PERIODS.

Art of the High Middle Ages; Romanesque and Gothic art. Emphasis on architecture, monumental sculpture, and painting in western Europe.

533. ISLAMIC ART AND ARCHITECTURE I.

Art and architecture of Islamic peoples from their origins up to the Mongol invasions in the 13th century.

Mr. Denny.

535. ISLAMIC ART AND ARCHITECTURE II.

Art and architecture of Islamic peoples from the 14th century to our time.

Mr. Denny.

545. ITALIAN ART OF THE EARLY AND HIGH RENAISSANCE (1400-1520).

The development of Italian art and architecture of the 15th and early 16th centuries in historical context.

Mrs. Cheney.

547. ITALIAN ART OF THE LATE RENAISSANCE AND MANNERISM.

The dissolution of the High Renaissance; proto-Baroque and early Mannerist art; the courtly Mannerism of the revived feudal class after 1530; the artistic response to the Counter-Reformation.

Prerequisite, Art 545 or permission of instructor.

Mrs. Cheney.

561. THE ARTS OF AFRICA, OCEANIA, AND PRE-COLUMBIAN AMERICAS.

An introduction to the so-called "primitive arts" of traditional peoples of Africa, Oceania, and pre-Columbian Americas.

563. AFRICAN ART.

A survey of ancient, traditional, and contemporary art and architecture of Western and Central Africa. Emphasis on art in its cultural context.

565. BAROQUE ART AND ARCHITECTURE IN NORTHERN EUROPE.

Art and architecture in France, Flanders, Holland, Germany, and Austria from 1600 to 1750. Students are encouraged to take Art 113 or 115 before taking this course.

Mr. Wiedenhoeff.

571. ART OF INDIA.

The effect of the great Eastern religious movement on art in India and surrounding territories. Some attention to secular art and architecture in modern times.

Mr. Tarr.

573. THE HINDU TEMPLE.

The conception and development of the Hindu temple in South and Southeast Asia. Emphasis on the structural traditions of the regions covered.

Mr. Tarr.

575. CHINESE PAINTING.

Shang tomb paintings; Han, Sung, Yuan, Ming, and Ch'ing Dynasty art; and the interplay between the art of Japan and the West.

Mr. Tarr.

577. ART OF BUDDHISM.

The development of Buddhist arts as they spread through Central Asia into East Asia and through Southeast Asia. The influence of the changing religion on the arts.

Mr. Tarr.

585. EUROPEAN ART, 1780-1880.

Major developments in painting from David to Post-Impressionism in France, England, and Germany.

Mr. Roskill.

587. MODERN ART, 1880 TO THE PRESENT.

Emphasis on major artists such as late Cezanne and Gauguin, Picasso, Matisse, Klee, Jackson Pollock, Optical and Pop artists. Main developments of style in relation to these artists.

Mr. Roskill.

591. MODERN ARCHITECTURE, NINETEENTH CENTURY.

Developments in the late 18th century and the history of the changes in style, technical advances, and aesthetic principles during the 19th century in Europe and America.

Mr. Norton.

593. MODERN ARCHITECTURE,
TWENTIETH CENTURY.

Developments in Europe and America, including influential personalities, social and political influences, structural innovations, and aspects of city planning.

Mr. Wiedenhoeft.

595. AMERICAN ART.

The earliest colonial art, the impact of later European influences, regional art of the 19th and 20th centuries, and contemporary developments.

605. ART OF EARLY MEDITERRANEAN
CULTURES.

The art of high cultures of the Bronze Age: Egyptian, Mesopotamian, Aegian, Hittite, and related cultures.

Mr. Benson.

625. MEDIEVAL PAINTING.

Early Christian to later medieval painting in Eastern and Western Europe.

627. SUMPTUARY ARTS OF THE MIDDLE AGES.

The technique, style, function, and symbolism of liturgical and secular objects in precious materials from Early Christian through Gothic periods.

Prerequisite, Art 225 or 227 or permission of instructor.

663. SEMINAR ON AFRICAN ART.

Methodology, authentication, and in-depth stylistic analysis of traditional African art.

Prerequisite, Art 263 or permission of instructor.

671, 673. GREAT THEMES IN ART HISTORY.

Central themes, issues, and problems of an important area in the history of art.

675, 677. MASTERS OF WESTERN ART.

An intensive study of the work of a master in the field of art. 1 or 2 class hours.

Prerequisite, permission of instructor.

Credit, 1-2.

681, 683. METHODS OF ART HISTORY.

An introduction to methods of study in this field emphasizing differing approaches to the work of art.

691. SEMINAR IN ROMAN ART.

Origins and development of Roman architecture, portraiture, historical relief, painting, and mosaics.

Prerequisite, Art 115 or 505, or Ancient History, or permission of instructor.

Mr. Benson.

693. CRITICISM OF MODERN ART—SEMINAR.

Practical exercises in the evaluation of modern paintings. Discussion of the results.

Credit, 2. Mr. Roskill.

697. ASPECTS OF AMERICAN ARCHITECTURE.

Changes in style, technique, and aesthetic principles of architecture in the United States.

Astronomy

(Five-College Cooperative Program)

GRADUATE FACULTY

WILLIAM M. IRVINE, *Head of the Astronomy Program and Professor*, B.A., Pomona College, 1957; M.A., Harvard, 1958; Ph.D., 1961.

EDWARD R. HARRISON, *Professor and Director of Graduate Studies*, Graduate, Institute of Physics, England, 1949; Associate, 1956; Fellow, 1963.

THOMAS T. ARNY, *Associate Professor*, B.A., Haverford, 1961; Ph.D., Arizona, 1965.

TOM R. DENNIS, *Assistant Professor* (Mount Holyoke College), B.A., University of Michigan, 1963; M.S. (Astronomy), 1964; M.S. (Astrophysical Sciences), Princeton, 1966; Ph.D., 1970.

WILLIAM A. DENT, *Assistant Professor*, B.S., Case Institute of Technology, 1960; M.S., University of Michigan, 1962; Ph.D., 1965.

H. MARK GOLDENBERG, *Associate Professor of Physics*.

COURTNEY P. GORDON, *Assistant Professor* (Hampshire College), B.A., Vassar, 1961; M.A., University of Michigan, 1963; Ph.D., 1967.

KURTISS J. GORDON, *Assistant Professor* (Hampshire College), B.S., Antioch, 1964; M.A., University of Michigan, 1966; Ph.D., 1969.

GEORGE S. GREENSTEIN, *Assistant Professor* (Amherst College), B.S., Stanford, 1962; Ph.D., Yale, 1968.

EVERETT M. HAFNER, *Dean of the School of Natural Science*, Hampshire College; B.S., Union, 1940; Ph.D., Rochester, 1948.

G. RICHARD HUCUENIN, *Professor*, B.S., Massachusetts Institute of Technology, 1959; Ph.D., Harvard, 1964.

ROBERT V. KROTKOV, *Associate Professor of Physics*.

RICHARD N. MANCHESTER, *Assistant Professor*, B.S., University of Canterbury, New Zealand, 1964; Ph.D., University of Newcastle, Australia, 1969.

WALTRAUT C. SEITTER, *Professor* (Smith College), M.A., Smith College, 1955; Ph.D., University of Bonn, Germany, 1962.

JOHN D. STRONG, *Professor*, B.A., Kansas, 1926; Ph.D., Michigan, 1930.

EUGENE TADEMARU, *Assistant Professor*, B.S., University of Illinois, 1964; Ph.D., University of Chicago, 1969.

JOSEPH H. TAYLOR, JR., *Assistant Professor*, B.A., Haverford, 1963; Ph.D., Harvard, 1968.

DAVID J. VAN BLERKOM, *Assistant Professor*, B.S., City College of New York, 1963; Ph.D., Colorado, 1969.

Students entering the master's and doctor's programs in astronomy are expected to have a sound background in undergraduate physics. Previous training in astronomy is helpful but not required.

The candidate for a master's degree generally takes a normal course load during the first year. The second year is devoted principally to either research directed toward a thesis or advanced course work. Physics courses are included with astronomy courses for determination of the total graduate credits in the major field. If a thesis is offered, at least 6 credits must be earned in 700-900 series astronomy courses; if a thesis is not offered, 12 credits must be earned in 700-900 series astronomy courses. A general examination must be passed before the degree is awarded.

The general requirements for the Ph.D. in astronomy are those of the Graduate School. A student takes a normal load of basic courses during the first two years. After passing the qualifying examination, the student is expected to devote his major effort to research. Research problems may be in either theoretical or observational areas. There is no foreign

language requirement for the Ph.D. in astronomy. The basic courses of the program are 643, 644, 730, 740, 741, and 743. In addition, students will normally take several courses from Physics 701, 702, 703, 704, 705, 706, 707, and 718.

ALL COURSES CARRY 3 CREDITS UNLESS OTHERWISE SPECIFIED

COURSES OPEN TO GRADUATE STUDENTS ONLY

700. INDEPENDENT STUDY.

Special study in some branch of astronomy or astrophysics, either theoretical or experimental, under direction of a faculty member. May be repeated for credit. Prerequisites, permission of the Head of the Astronomy program and the directing faculty member. *Credit, 1-6.*

730. RADIO ASTROPHYSICS.

The physical theory fundamental to radio astronomy: propagation of electromagnetic waves in isotropic and anisotropic media with emphasis on plasmas, Faraday rotation, the emission and absorption of synchrotron radiation and bremsstrahlung emission, spectral lines at radio frequencies; nonthermal radio source models. Prerequisites, Physics 552 and 586. *Mr. Dent.*

731. RADIO ASTRONOMY.

An introduction to observational radio astronomy. Topics include: a brief survey of areas to which radio observations have made important contributions; antenna systems, interferometers, radiometric systems, and other instrumentation; observing methods and techniques. Prerequisites, physics 552 and Math 641 or equivalent. *Mr. Huguenin.*

740. GALACTIC AND EXTRA-GALACTIC ASTRONOMY.

The stellar density and luminosity functions as applied to the problem of galactic structure. Determination of the galactic force field from stellar motions. Spiral structure, star clusters and their stability. Prerequisite, Physics 556. *Mr. Huguenin.*

741. THE INTERSTELLAR MEDIUM.

Observed properties of the interstellar medium from optical and radio data: composition, distribution, and motions. Transfer of dilute radiation and its production in a rarefied gas. The dynamics of the gas as influenced by radiation and gravity. Prerequisite, Astron 644 or permission of instructor. *Mr. Army.*

743. STELLAR ATMOSPHERES.

Theory of stellar atmospheres. Observational methods and observational data, formation of the continuous spectrum, line formation and curve of growth techniques in normal stars, stars with envelopes, variable stars, novae, magnetic fields in stars. Departure from local thermodynamic equilibrium. Prerequisite, Astron 644. *Mr. Van Blerkom.*

744. STELLAR STRUCTURE.

Stellar structure and evolution: energy generation and transfer in the interior of stars, convective and radiative equilibrium, the computation of stellar models and evolution of young and old stars, red giants, pulsating stars, novae, and white dwarfs. Prerequisites, Astron 643, COINS 409, or equivalent. *Mr. Harrison.*

745. THE SUN.

The determination of physical conditions in the solar atmosphere using the various observational data. The features of both the quiet and the active sun: granulation, limb darkening, plagues, sunspots, etc. Solar-terrestrial relationships. Prerequisite, Astron 644.

746. SOLAR SYSTEM PHYSICS.

The physics and chemistry of planetary atmospheres, surfaces, and interiors. Comets, meteors, and asteroids. The solar wind, solar terrestrial relations, and the interplanetary medium. Advanced topics in mechanics applicable to astronomical problems. Prerequisites, Physics 552 and 556 and Astron 644, or permission of instructor. *Mr. Irvine.*

748. COSMOLOGY AND GENERAL RELATIVITY.

Observational cosmology and cosmological Principles. Background radiation and Olbers' paradox. Newtonian cosmology. General relativity, gravitational waves, relativistic cosmology, and gravitational collapse. Theories of the universe and the origin of celestial structure. Prerequisite, Physics 585. *Mr. Harrison.*

797, 798. SEMINAR - REVIEW OF CURRENT LITERATURE.

Discussion and review of current articles in the astronomical literature. May be repeated for credit. Required of graduate students. *Credit, 1 each semester.*

850. ADVANCED TOPICS IN ASTRONOMY.

Topics of special interest not covered in regular courses. Prerequisite, permission of instructor.

860. SEMINAR ON RESEARCH TOPICS IN ASTRONOMY.

Topics of current interest not covered in regular courses. Instruction via reading assignments and seminars. May be repeated for credit. Prerequisite, permission of instructor. *Credit, 1-3.*

800. MASTER'S THESIS.

Credit, variable.

900. DOCTORAL DISSERTATION

Credit, variable.

COURSES OPEN TO BOTH GRADUATE AND UNDERGRADUATE STUDENTS (For either major or minor credit)

538. TECHNIQUES OF MODERN ASTRONOMY.

An introduction to modern methods of astronomical observation and data reduction. Specific techniques of optical astronomy, radio astronomy, and space astronomy discussed and analyzed. Laboratory experiments and field observations. Prerequisites, Physics 113 or 107. *Mr. Huguenin.*

643. ASTROPHYSICS I.

Basic topics in astronomy and astrophysics. Gravitational equilibrium configurations, virial theorem, polytropes, hydrodynamics, thermodynamics, radiation transfer, convective and radiative equilibrium, stellar and planetary atmospheres, the equations of stellar structure. Miscellaneous topics on the physics of stellar and galactic structure. Prerequisite, permission of instructor. *Credit, 4. Mr. Harrison.*

644. ASTROPHYSICS II.

Atomic physics and opacity. Nuclear physics and nucleosynthesis in stars. Gravitational instability and star formation. Stellar evolution and electron-degenerate configurations. Gravitational collapse. Topics in plasma physics and the propagation of electromagnetic waves. Topics in magnetohydrodynamics and Alfvén waves. Dynamic and kinematic principles of cosmology and a review of the underlying physical processes. Prerequisite, Astron 643. *Credit, 4. Mr. Harrison.*

RELATED COURSES

Physics

701. CLASSICAL MECHANICS.

- 702. STATISTICAL PHYSICS.
- 703. INTRODUCTORY QUANTUM MECHANICS I.
- 704. INTRODUCTORY QUANTUM MECHANICS II.
- 705. METHODS OF MATHEMATICAL PHYSICS.
- 706. CLASSICAL ELECTRODYNAMICS I.
- 707. CLASSICAL ELECTRODYNAMICS II.
- 718. BASIC PHYSICS OF ATOMS AND MOLECULES.

Biochemistry

GRADUATE FACULTY

R. C. FULLER, *Head of the Department of Biochemistry and Professor*, B.A., Brown, 1947; M.A., Amherst College, 1948; Ph.D., Stanford, 1952.

JOHN F. BRANDTS, *Professor of Chemistry*.

PAT W. CAMERINO, *Associate Dean for Research and Associate Professor*.

MAURILLE J. FOURNIER, *Assistant Professor*, B.A., Vermont, 1962; Ph.D., Dartmouth, 1967.

ANTHONY M. GAWIENOWSKI, *Associate Professor*, B.A., Villanova, 1948; M.A., Missouri, 1953; Ph.D., 1956.

HENRY N. LITTLE, *Professor*, B.S., Cornell, 1942; M.S., Wisconsin, 1946; Ph.D., 1948.

THOMAS L. MASON, *Assistant Professor*, B.S., Wisconsin, 1962; M.S., Louisiana, 1965; Ph.D., Minnesota, 1970.

JOHN H. NORDIN, *Associate Professor*, B.S., Illinois, 1956; Ph.D., Michigan State, 1961.

PETER PARSONS, *Assistant Professor*, B.A., Colby, 1955; Ph.D., Pittsburgh, 1963.

TREVOR ROBINSON, *Associate Professor*, B.A., Harvard, 1950; M.A., 1951; M.S., Massachusetts, 1953; Ph.D., Cornell, 1956.

ALLEN E. SILVERSTONE, *Assistant Professor*, B.A., Reed, 1964; Ph.D., MIT, 1970.

EDWARD W. WESTHEAD, *Professor*, B.S., Haverford, 1951; M.S., 1952; Ph.D., Brooklyn Polytechnic, 1955.

GENERAL INFORMATION

Candidates for the degrees of Master of Science and Doctor of Philosophy in Biochemistry are accepted for admission under the general regulations of the Graduate School. Students normally must complete the following undergraduate courses before admission to either degree program: two semesters each of organic chemistry, physical chemistry; a year of calculus, physics and biology. As part of these requirements, all students prior to their first registration must take achievement or placement exams in the areas of organic chemistry, analytical chemistry, and physical chemistry. Satisfactory completion of the admission requirements will be judged by the Graduate Study Committee of the Depart-

ment on evidence of the student's undergraduate transcript and his scores on these examinations. Those students with deficiencies must remove them at the earliest possible date by taking the appropriate courses. Students may register for graduate credit courses while doing this remedial work, but no graduate credit is given for such remedial courses.

SUMMARY OF REQUIREMENTS FOR THE PH.D. DEGREE

Upon entrance a student is assigned an adviser who will work out the first-year courses, seminar and research programs with the entering student. At the end of the first two semesters the student must have remedied his deficiencies, if any; have taken the equivalent of one year's graduate study in biochemistry (including laboratory work); and participated in the biochemistry seminar specially designed to familiarize entering students with the research work of the faculty and the pertinent literature.

All students must attend regular departmental seminars. A comprehensive examination (of the research-proposal and written-comprehensive type) is required of all Ph.D. students. The Department currently requires one foreign language to be passed under departmental supervision. In addition to the comprehensive examination, all Ph.D. students must complete the preparation of a dissertation satisfactory to their Guidance Committees and pass a final oral examination on that dissertation.

SUMMARY OF REQUIREMENTS FOR THE M.S. DEGREE

Entrance requirements for the master's degree are similar to those for the Ph.D. degree. They may be fulfilled by remedial work during the first year. All students are expected to participate in the biochemistry seminar during their first year and to complete 30 graduate credits, no more than 10 of which may be earned by means of a thesis. A thesis presentation and an oral examination on the thesis are required.

GENERAL REQUIREMENTS FOR ALL GRADUATE STUDENTS

All entering candidates for either the M.S. or Ph.D. degree must participate in a special in-depth seminar, which will cover the research work of the members of the Biochemistry Department, and in one or more research projects before the end of the first year of studies. It is expected that the master's degree will take two years to complete, and the Ph.D. degree two years after the award of a master's degree from this or another institution.

ALL COURSES CARRY 3 CREDITS UNLESS OTHERWISE SPECIFIED

COURSES OPEN TO GRADUATE STUDENTS ONLY

724. SPECIAL TOPICS IN BIOCHEMISTRY.

Topics of current interest which may include hormones, lipids, carbohydrates, control mechanisms, and protein synthesis.

Prerequisite, Biochem 524.

725. ADVANCED BIOCHEMICAL TECHNIQUES.
A laboratory course to provide experience in isolation, identification and analysis of biochemical compounds.
Prerequisites, Biochem 524, and either 525, 526, 527 or equivalent.
Credit, 2-5. Mr. Parsons.

726. EXPERIMENTAL ENZYMOLOGY.
A laboratory course. Experience in the preparation, assay, and physical characterization of enzymes.
Prerequisite, Biochem 525, 526.
Credit, 2. Mr. Westhead.

728. PROTEIN PHYSICAL CHEMISTRY.
The chemical, physical, and biological properties of proteins.
Prerequisites, Biochem 524 and Chem 586. Mr. Brandts.

729. ENZYMES.
Basic aspects of enzyme assay, preparation, kinetics, and properties. Topics of current importance such as studies on active sites, mechanisms, and controls of enzyme action.
Prerequisite, Biochem 524.
Credit, 2. Mr. Westhead.

731. PLANT BIOCHEMISTRY.
The chemistry and metabolism of plants with particular emphasis on higher plants. Topics such as nitrogen metabolism, photosynthesis, and the chemistry of compounds peculiar to plants.
Prerequisite, Biochem 524.
Credit, 2. Mr. Robinson.

891. SEMINAR.
Required of all students. Oral report on a topic of current interest and preparation of a research proposal based on the seminar topic.
Credit, 1 each semester.

800. MASTER'S THESIS. *Credit, 10.*

900. DOCTORAL DISSERTATION. *Credit, 30.*

COURSES OPEN TO BOTH GRADUATE AND UNDERGRADUATE STUDENTS

523, 524. GENERAL BIOCHEMISTRY.
Introductory course for students majoring in chemistry or in the biological sciences. A background for more advanced or specialized study.
Prerequisites, Chem 166 or equivalent; second semester requires Chem 281 or equivalent.
Credit, 3 each semester. Mr. Little.

525, 526. BIOCHEMISTRY LABORATORY.
First semester: biochemical materials and standard biochemical techniques; second semester: more sophisticated experiments, with increased opportunity for initiative in experimental design. Density gradient ultracentrifugation, amino acid and peptide analysis, and separation and study of subcellular components.
Prerequisite, Chem 127 or equivalent.
Credit, 1 each semester. Mr. Parsons.

527 (I). BIOCHEMISTRY LABORATORY FOR MAJORS.

Similar to 525, 526 but concentrated into one semester and taught at a more advanced level.
Credit, 2. Mr. Parsons.

COURSES NOT FOR MAJOR CREDIT
(No graduate credit for students majoring in biochemistry.)

520. ELEMENTARY BIOCHEMISTRY.
The more important facts relating to biological materials and processes. Primarily for students not eligible for courses 523 or 524.
Not open to chemistry or biochemistry majors.
Three class hours, one 3-hour laboratory period.
Credit, 4. Mr. Robinson.

Botany

GRADUATE FACULTY

OTTO L. STEIN, Head of the Department of Botany and Professor, B.S., Minnesota, 1949; M.S., 1952; Ph.D., 1954.

PAUL E. BARRETT, Assistant Professor, B.S., University of New Hampshire, 1964; M.S., 1966; Ph.D., British Columbia, 1972.

DAVID W. BIERHORST, Professor, B.S., Tulane University, 1947; M.S., 1949; Ph.D., University of Minnesota, 1952.

HOWARD E. BIGELOW, Professor, B.A., Oberlin, 1949; M.A., 1951; Ph.D., Michigan, 1956.

MARGARET E. BARR BIGELOW, Associate Professor, B.A., University of British Columbia, 1950; M.A., 1952; Ph.D., Michigan, 1956.

EDWARD L. DAVIS, Associate Professor, B.A., Harvard, 1951; M.S., Massachusetts, 1953; Ph.D., Washington University, 1956.

SARA A. FULTZ, Assistant Professor, B.S., Purdue, 1951; M.S., Michigan, 1953; Ph.D., 1965.

PAUL J. GODFREY, Assistant Professor, B.S., University of Connecticut, 1962; Ph.D., Duke University, 1969.

EDWARD J. KLEKOWSKI, JR., Associate Professor, B.S., 1962; M.S., N.C. State University, 1964; Ph.D., University of California, Berkeley, 1968.

ROBERT B. LIVINGSTON, Professor, B.A., Colorado College, 1938; M.A., Duke, 1941; Ph.D., 1947.

JAMES A. LOCKHART, Professor, B.S., Michigan State, 1949; M.S., 1952; Ph.D., University of California at Los Angeles, 1954.

DAVID L. MULCAHY, Associate Professor, B.A., Dartmouth College, 1959; Ph.D., Vanderbilt University, 1963.

LIVIA RAUDZENS, Assistant Professor, B.A., Barnard College, 1961; M.A., Columbia University, 1964; Ph.D., Columbia University, 1967.

BERNARD RUBINSTEIN, Assistant Professor, B.S., Michigan State University, 1960; M.S., Purdue University, 1962; Ph.D., University of California at Berkeley, 1968.

RUDOLF M. SCHUSTER, Professor, B.S., Cornell, 1945; M.S., 1946; Ph.D., Minnesota, 1948.

SEYMOUR SHAPIRO, Professor, B.S., Michigan, 1947; Ph.D., 1953.

ALBERT C. SMITH, Ray Ethan Torrey Professor, B.A., Columbia University, 1926; Ph.D., Columbia University, 1933.

ARTHUR I. STERN, Associate Professor, B.S., City College of New York, 1953; Ph.D., Brandeis University, 1962.

CARL P. SWANSON, Professor, B.S., Massachusetts State College, 1937; M.A., Harvard University, 1939; Ph.D., Harvard University, 1941.

OSWALD TIPPO, Commonwealth Professor, B.S., Massachusetts, 1932; M.A., Harvard, 1933; Ph.D., 1937.

JAMES W. WALKER, *Assistant Professor, B.A., University of Texas, 1964; Ph.D., Harvard University, 1970.*

PETER L. WEBSTER, *Assistant Professor, B.S., University of St. Andrews, 1964; Ph.D., Western Reserve University, 1968.*

ROBERT T. WILCE, *Associate Professor, B.S., University of Scranton, 1950; M.S., Vermont, 1952; Ph.D., Michigan, 1957.*

Candidates for the degree of Master of Arts and for the degree of Doctor of Philosophy are accepted for admission under the general regulations of the Graduate School. Admission to advanced courses does not imply admission to candidacy for an advanced degree. Only students whose knowledge of botany and related chemical and physical sciences is considered by the Department to be adequate will be accepted as candidates for advanced degrees. Research work leading to the thesis may be selected from the fields of anatomy, cytology, ecology, morphology, morphogenesis, physiology, and taxonomy.

The Botany Department normally requires candidates for the Ph.D. degree to demonstrate on the intermediate level reading knowledge of two foreign languages, one of which must be German. Choice of the second language will be made after consultation between the student and his guidance committee. Waiving of the requirement for the second language requirement may be made by consultation of the student with his guidance committee and must be approved by the departmental Degree Requirements Committee.

COURSES OPEN TO GRADUATE STUDENTS ONLY
(For either major or minor credit)

ALL COURSES CARRY 3 CREDITS UNLESS OTHERWISE SPECIFIED

700. SPECIAL PROBLEMS.

Research not expected to terminate in a thesis; advanced study in special subjects. *Credit, 1-5 each semester.*

711, 712. ADVANCED PLANT PHYSIOLOGY.

Selected topics in plant physiology. Lectures, laboratory, and individual conferences.

Prerequisites, Botany 511 and permission of instructor.

Credit, 2-4 each semester.

Miss Fultz, Mr. Lockhart, Mr. Rubinstein, Mr. Stern.

715. PLANT GROWTH REGULATORS.

Recent advances in the field of plant growth regulators, including phytochrome, auxins, gibberellins, kinins, and herbicides. The mechanisms whereby these materials control plant growth and development. Possible experimental approaches.

Prerequisites, Botany 511 and one semester of biochemistry. *Mr. Rubinstein, Mr. Marsh.*

721. ADVANCED PLANT ECOLOGY.

Lectures, conferences, critical reading, and reports on advanced considerations of synecology and autecology. Prerequisite, Botany 521.

Mr. Godfrey, Mr. Livingston, Mr. Mulcahy.

731. ADVANCED MYCOLOGY.

Systematics and ecology of the higher ascomycetes and

basidiomycetes; problems in growth and nutrition of fungi.

Prerequisite, Botany 531 or equivalent.

Credit, 4.

Mr. H. E. Bigelow, Mrs. M. E. B. Bigelow.

741. ADVANCED PHYCOLOGY.

Detailed study of marine and fresh-water algae. Emphasis on phylogeny, life histories, and ecology.

Prerequisite, Botany 541 or equivalent.

Mr. Wilce.

750. PLANT PHOTOSYNTHESIS.

Lectures and discussions of the literature on the mechanisms and requirements of photosynthesis, including the light and dark reactions and the process of photorespiration.

Prerequisite, Botany 512 or Chem 524 or equivalent.

Mr. Baker, Mr. Stern.

761. BIOLOGY OF LOWER PLANTS.

The use of fungi and algae as experimental organisms for investigations in physiology and genetics.

Prerequisite, Botany 511, Zool 660, or Chem 524.

Credit, 4. Miss Fultz.

781. ADVANCED ANGIOSPERM SYSTEMATICS.

Consideration of angiosperm systematics and evolution at an advanced level. Topics may vary from year to year. May be repeated with permission of instructor.

Three class hours, one 3-hour laboratory-discussion period.

Prerequisite, Botany 528 and Botany 581, or permission of instructor.

Credit, 4. Mr. Walker.

800. MASTER'S THESIS.

Maximum credit, 10.

801. PLANT MORPHOGENESIS.

Lectures, discussions, and reading on the development of the plant body.

Prerequisites, Botany 591, Botany 511 or equivalent.

Mr. Shapiro, Mr. Stein.

825. PALYNOLOGY.

Comparative morphology of modern and fossil pollen grains and spores, including development of the pollen wall. Emphasis on the taxonomic use of pollen characters for angiosperm systematics.

Mr. Walker.

850. SEMINAR.

Credit, 1 each semester; maximum credit, 6.

900. DOCTORAL DISSERTATION.

Credit, 15.

COURSES OPEN TO BOTH GRADUATE AND UNDERGRADUATE STUDENTS

(For either major or minor credit)

511. INTRODUCTORY PLANT PHYSIOLOGY.

How the plant grows and feeds itself. Methods of communication among cells and organs, and between plant and environment.

Prerequisite, 1 semester organic chemistry. *Credit, 4.*

Miss Fultz, Mr. Lockhart, Mr. Rubinstein, Mr. Stern.

512. PLANT METABOLISM.

The basic metabolic processes in plants including carbohydrate metabolism, glycolysis, respiration, photosynthesis, lipid metabolism and protein synthesis. Biological as well as chemical approach. Emphasis on free energy changes and the enzymatic reactions and pathways involved. *Credit, 4. Mr. Jennings, Mr. Marsh, Mr. Stern.*

515. PLANT GROWTH

Description and analysis of the physiology, kinetics, and energetics of plant growth; the methods used to study growth. Cells, tissues, whole plants, and assemblages of plants.

Prerequisites, Botany 511 and College Physics.

Mr. Lockhart.

519. ECOLOGICAL PLANT PHYSIOLOGY.

Physiology of plants in relation to the classes of prob-

lems they face and the various strategies evolved for survival and growth.

Prerequisites, Botany 211 and one semester of differential calculus. Mr. Lockhart.

521. PLANT ECOLOGY.

Interrelationships between plants and their environment; the structure and development of plant communities. Mr. Barrett, Mr. Godfrey, Mr. Mulcahy.

522. AUTECOLOGY.

Plant behavior in relation to the physical and biological environment. Emphasis on the ecology of individual plants.

Prerequisites, Botany 511 and 521. Mr. Godfrey.

526. PLANT GEOGRAPHY.

Principles governing the development and natural distribution of plants and plant communities. Special consideration of the vegetation of North America.

Prerequisite, Botany 521. Mr. Godfrey, Mr. Livingston.

528. PRINCIPLES OF EVOLUTION.

Ecological phenomena through the application of genetic concepts. The adaptation of individuals, populations, and communities as functional units.

Prerequisite, introductory botany or zoology.

Mr. Mulcahy.

531. GENERAL MYCOLOGY.

Survey of the various fungi, their life history and distribution, their significance in disease, their utilization by man.

Mr. Bigelow.

541. PHYCOLOGY.

The phylogeny, taxonomy, morphology, and ecology of the major groups of marine and fresh water algae. Includes field work in both marine and fresh water environments.

Mr. Wilce.

551. THE ARCHEGONIATES.

The morphology, evolution, and systematics of primitive land plants. Emphasis on evolution and systematics of Bryophyta.

Mr. Schuster.

555. EXPERIMENTAL PTERIDOLOGY.

An integrated view of physiological and genetical parameters of the pteridophyte life cycle. The research potential of these organisms.

Prerequisites, Botany 240 or Zool 240, and Botany 211.

Mr. Klekowski.

570. CYTOGENETICS.

The correlation of genetic data with chromosome behavior, including an analysis of the mechanism of crossing over. Evolutionary considerations of changes in chromosome structure and number.

Prerequisites, Zool 540 and a cytology course preferred.

Mr. Swanson.

580. ORIGIN, EVOLUTION, AND DISTRIBUTION OF FLOWERING PLANTS.

Survey of evolutionary history of primitive flowering plants and the significance of their geographic distribution.

Prerequisite, Botany 125 or equivalent. Recommended, Botany 581, 591.

Credit, 4. Mr. Smith.

581. INTRODUCTORY ANGIOSPERM SYSTEMATICS.

The evolution and systematics of flowering plants, emphasizing families and their relationships.

Credit, 4. Mr. Walker.

591. PLANT ANATOMY AND HISTOLOGICAL METHODS.

Origin and structure of vegetative and reproductive

organs of seed plants coordinated with exercises in preparation of stained slides for microscopic studies.

Credit, 4. Mr. Bierhorst.

601. MORPHOGENESIS.

Lectures and laboratory exercises demonstrating the development of plant form utilizing examples from throughout the plant kingdom.

Mr. Davis.

603. PLANT MORPHOLOGY.

The life cycles of various non-vascular plant taxa, the dynamics of their evolution and the interpretation of various morphological structures.

Prerequisite, Botany 100 or permission of instructor.

Credit, 4. Mrs. Bigelow, Mr. Schuster, Mr. Wilce.

604. PLANT MORPHOLOGY.

As 603, but vascular plant taxa.

Credit, 4. Mr. Bierhorst, Mr. Schuster.

611. CYTOLOGY.

Development, structure, and function of cell organelles; cell reproduction and differentiation, with reference to the behavior and role of the nucleus.

Mr. Stein, Mr. Swanson, Mr. Webster.

COURSES NOT FOR MAJOR CREDIT

635. AQUATIC VASCULAR PLANTS.

Systematics, ecology, and fundamental importance of aquatic plants. For majors in Wildlife.

Two 3-hour class-laboratory periods.

Prerequisites, Botany 100 and 126.

Mr. Ahles.

Business Administration

GRADUATE FACULTY

WENDELL R. SMITH, *Dean of the School of Business Administration and Professor*, B.S., State University of Iowa, 1932; M.A., 1935; Ph.D., 1941.

JOHN T. CONLON, *Associate Dean and Professor of Management*, B.B.A., Massachusetts, 1949; M.A., Connecticut, 1951; Ph.D., Michigan State, 1960.

JOHN W. ANDERSON, *Professor of Accounting*, B.S., Indiana University, 1949; M.B.A., 1953; C.P.A., Maine, 1952.

MORTON BACKER, *Professor of Accounting*, B.B.A., Boston University, 1939; M.Lt., University of Pittsburgh, 1950; Ph.D., 1958; C.P.A., New York and West Virginia, 1941.

JOSEPH L. BALINTFY, *Professor of Management Science and Operations Research*.

ALEXANDER BARGES, *Chairman of the Department of General Business and Finance, and Associate Professor of General Business and Finance*, B.S., University of California, 1956; M.B.A., Northwestern University, 1956; Ph.D., 1962.

MARY K. BARBER, *Assistant Professor of Marketing*, B.S., Massachusetts State College, 1944; M.A., New York University, 1948; Ph.D., 1969.

MEYER W. BELOVICZ, *Associate Professor of General Business and Finance*, B.S., Illinois Institute of Technology, 1961; M.B.A., Northwestern University, 1963; Ph.D., 1967.

JOHN J. BONSIGNORE, *Associate Professor of General Business and Finance*, B.A., Trinity College, 1957; J.D., University of Chicago Law School, 1969.

- TIM BORNSTEIN, *Associate Professor of Management*, B.A., University of Louisville, 1954; J.D., Harvard University, 1957.
- VICTOR P. BUELL, *Associate Professor of Marketing*, B.A., Pennsylvania State University, 1938.
- JOHN G. BURCH, JR., *Assistant Professor of Accounting*, B.S., Louisiana Polytechnic Institute, 1965; M.A., University of Alabama, 1967; Ph.D., 1968.
- D. ANTHONY BUTTERFIELD, *Assistant Professor of Management*, B.S., Yale, 1961; M.A., Michigan, 1963; Ph.D., 1968.
- ARTHUR E. CARLISLE, *Associate Professor of Management*, B.A., McGill, 1948; M.B.A., Michigan, 1963; Ph.D., 1966.
- GORDON K.C. CHEN, *Associate Professor of Management*, B.S., Great China University, 1945; M.A., University of Iowa, 1950; Ph.D., 1956.
- PAO L. CHENG, *Professor of General Business and Finance*, B.S., National Chiotung China, 1944; M.A., Missouri, 1949; Ph.D., Wisconsin, 1956.
- C. MARC CHOATE, *Assistant Professor of Finance*, B.A., University of Washington, 1964; M.B.A., 1967; D.B.A., 1970.
- SIDNEY J. CLAUNCH, *Associate Professor of Management*, B.A., Ohio, 1949; M.B.A., Wisconsin, 1951; Ph.D., 1958.
- A. WAYNE CORCORAN, *Professor of Accounting*, B.S., Cornell University, 1954; M.S., University of Rochester, 1969; Ph.D., State University of New York at Buffalo, 1966; C.P.A., New York, 1969.
- M. KING DEETS, *Associate Professor of General Business and Finance*, B.A., University of Iowa, 1961; M.A., 1963; Ph.D., 1968.
- CARL DENNLER, JR., *Chairman of the Department of Accounting and Professor of Accounting*, B.S., University of Missouri, 1948; M.A., 1950; Ph.D., Wisconsin, 1962.
- ARTHUR ELKINS, *Associate Professor of Management*, B.B.A., Massachusetts, 1957; M.S., Columbia, 1958; D.B.A., Indiana, 1967.
- FREDERICK E. FINCH, *Associate Professor of Management*, B.S., Kent State University, 1961; M.B.A., 1963; D.B.A., University of Washington, 1966.
- DONALD G. FREDERICK, *Associate Professor of Marketing*, B.S., Indiana University, 1957; M.B.A., 1958; D.B.A., Washington University, 1964.
- M. WILLIAM FREY, *Associate Professor of Management*, B.S., Pennsylvania State, 1956; M.A., Connecticut, 1957; Ph.D., Pennsylvania State, 1963.
- JOSEPH P. GUILTINAN, *Assistant Professor of Marketing*, B.B.A., University of Notre Dame, 1966; M.B.A., Indiana University, 1968; D.B.A., 1969.
- VAN COURT HARE, JR., *Professor of Management*, B.S., Massachusetts Institute of Technology, 1950; M.A., Columbia, 1953; Ph.D., 1961.
- H. RICHARD HARTZLER, *Professor of General Business and Finance*, B.A., Indiana University, 1950; J.D., 1955.
- LAWRENCE A. JOHNSON, *Assistant Dean of the School of Business Administration and Associate Professor*, B.S.B.A., Boston University, 1955; M.B.A., 1958; Ph.D., Stanford University, 1970.
- HALSEY R. JONES, *Assistant Professor of Management*, B.A., University of Virginia, 1954; M.S., Pennsylvania State University, 1959; Ph.D., 1966.
- EUGENE E. KACZKA, *Associate Professor of General Business and Finance*, B.S., Rensselaer Polytechnic Institute, 1960; M.S., 1961; Ph.D., 1966.
- ANTHONY T. KRZYSTOFIK, *Associate Professor of Accounting*, B.S., American International College, 1952; M.A., University of Connecticut, 1961; C.P.A., Massachusetts, 1956.
- PREM KUMAR, *Assistant Professor of Finance*, B.S., University of Delhi, India, 1965; M.S., University of Wisconsin, 1967; Ph.D., 1970.
- ROBERT W. LENTILHON, *Professor of Accounting*, B.S., University of Rhode Island, 1949; M.B.A., Boston University, 1963; C.P.A., Massachusetts.
- JOSEPH A. LITTERER, *Professor of Management*, B.S., Drexel Institute of Technology, 1950; M.B.A., 1955; Ph.D., University of Illinois, 1959.
- JAMES B. LUDTKE, *Professor of General Business and Finance*, B.A., State University of Iowa, 1947; M.A., 1948; Ph.D., 1951.
- ROBERT E. MCGARRAH, *Professor of Management*, B.S., Lafayette College, 1943; M.S., Princeton University, 1948; Ph.D., Cornell University, 1951.
- STEPHEN R. MICHAEL, *Associate Professor of Management*, B.A., Rutgers University, 1948; M.A., Harvard University, 1949; Ph.D., Columbia University, 1967.
- KENT B. MONROE, *Associate Professor of Marketing*, B.A., Kalamazoo College, 1960; M.B.A., Indiana University, 1961; D.B.A., University of Illinois, 1968.
- ULA K. MOTEKAT, *Assistant Professor of Accounting*, B.S., University of Denver, 1964; M.B.A., University of Denver, 1966; D.B.A., University of Colorado, 1972.
- WALTER G. O'DONNELL, *Professor of Management*, LL.B., John Marshall Law School, 1930; B.A., Western Reserve, 1932; M.A., 1943; Ph.D., Columbia, 1959.
- GRANT M. OSBORN, *Professor of General Business and Finance*, B.S., Brigham Young University, 1948; M.B.A., Stanford University, 1950; Ph.D., University of Pennsylvania, 1955.
- GORDON W. PAUL, *Associate Professor of Marketing*, B.S., University of Tulsa, 1955; M.B.A., University of Texas, 1962; Ph.D., Michigan State University, 1966.
- ROBERT H. PLATTNER, *Associate Professor of General Business and Finance*, B.S., University of Missouri, 1950; M.B.A., Ohio State University, 1962; Ph.D., University of Michigan, 1968.
- ROBERT L. RIVERS, *Professor of General Business and Finance*, B.A., Clark University, 1943; M.S., Illinois, 1947; Ph.D., 1957.
- KENEN SAHIN, *Associate Professor of Management*, B.S., Massachusetts Institute of Technology, 1963; Ph.D., 1969.
- ALAN C. SAWYER, *Assistant Professor of Marketing*, B.S., University of Maine, 1965; M.B.A., Northeastern University, 1967; Ph.D., Stanford University, 1970.

CHARLES D. SCHEWE, *Assistant Professor of Marketing*, B.A., University of Michigan, 1965; M.B.A., University of Michigan, 1965; Ph.D., Northwestern University, 1971.

GEORGE SCHWARTZ, *Associate Professor of Marketing*, B.A., Brooklyn College, 1943; Ph.D., Pennsylvania, 1960.

GEORGE B. SIMMONS, *Chairman of Department of Management and Professor of Management*, B.A., University of Louisville, 1953; M.B.A., Indiana University, 1957; D.B.A., 1961.

RICHARD H. SIMPSON, *Associate Professor of Accounting*, B.B.A., University of Massachusetts, 1958; M.B.A., University of North Carolina, 1961; Ph.D., 1967; C.P.A., North Carolina, 1964.

FRANK A. SINGER, *Professor of Accounting*, B.S., Indiana, 1948; M.B.A., 1949; D.B.A., 1955.

DONALD E. STONE, *Associate Professor of Accounting*, B.S., Lehigh University, 1961; M.B.A., University of Wisconsin, 1952; Ph.D., 1965; C.P.A., Wisconsin, 1965.

WILLIAM B. WHISTON, *Director of the Center for Business and Economic Research and Associate Professor of General Business and Finance*, B.A., Amherst College, 1943; B.D., Yale University, 1947; B.S., Massachusetts Institute of Technology, 1949; M.S., University of Cincinnati, 1964; M.A., Harvard University, 1967; Ph.D., 1972.

JAMES L. WIEK, *Assistant Professor of Marketing*, B.B.A., University of Washington, 1963; M.B.A., 1964; Ph.D., Michigan State University, 1969.

JACK S. WOLF, *Chairman of Department of Marketing and Professor of Marketing*, B.A., Coe College, 1949; M.B.A., Wharton, 1950; Ph.D., State University of Iowa, 1957.

PARKER M. WORTHING, *Associate Professor of Marketing*, B.S., University of Maine, 1962; M.B.A., Michigan State University, 1964; Ph.D., 1968.

MAX S. WORTMAN, JR., *Professor of Management*, B.S., Iowa, 1956; Ph.D., Minnesota, 1962.

STANLEY YOUNG, *Professor of Management*, B.A., Washington University, 1949; M.B.A., Pennsylvania, 1951; Ph.D., 1956.

The School of Business Administration is a fully accredited member of the American Association of Collegiate Schools of Business (AACSB). The Ph.D. and two different master's degree programs are offered.

The program of graduate courses in business administration is designed to prepare students for positions of responsibility in business, in organizations that serve business, in government, and in related fields of teaching.

THE DOCTOR OF PHILOSOPHY DEGREE

The graduate program leading to the degree of Doctor of Philosophy in business administration is designed primarily for students interested in a career in college teaching, service, and research. A minimum of three years is normal for the degree. Application requirements are described later in this listing.

A minimum ATGSB score of 550 is required, but a higher score may be necessary depending upon the applicant's previous record. A summary of the requirements for the degree follows:

1. At least two years of formal resident course study involving not less than 48 hours nor more than 72 credit-hours are required.

2. Prerequisites or foundation course work may be required depending upon the student's previous preparation at time of admission. Evaluation of this preparation will be based upon the requirements of a minimum of: 12 credits in business administration; 6 credits in micro- and macroeconomic theory beyond a 6-credit introductory economics requirement; 9 credits in mathematics, including finite mathematics, differential and integral calculus; 6 credits of statistics; and 6 credits in the behavioral sciences. Individual requirements shall be determined by the Director of Graduate Studies and the student's adviser.

3. Core requirements for the program include: 6 credits in the behavioral sciences in business administration, 6 credits in statistical methods in business administration, and 6 credits in micro- and macroeconomic theory.

4. Upon completion of the core requirements, but not later than the completion of 24 doctoral level credits, the student is required to take a written Preliminary Examination, measuring his ability to integrate knowledge gained in that work. This test is administered by the student's adviser and at least four members of the graduate faculty. Eligibility for further study is considered at this point.

5. The student selects a field of concentration from among the following alternatives:

a. Functional Fields.

- i. Accounting.
- ii. Finance.
- iii. Industrial and Personnel Relations.
- iv. Marketing.
- v. Production.

b. General Fields.

- i. Business and its Environment.
- ii. Information and Control Systems.
- iii. Organizational and Administrative Behavior.
- iv. Quantitative Management Science.
- v. In conjunction with his adviser and the Director of Graduate Studies, a course plan is developed to achieve the concentration desired.

6. Upon completion of 30 credits of graduate study beyond the Core requirements, the student shall take a written and oral Candidacy Examination, administered by the Doctoral Adviser and Doctoral Committee.

7. In conjunction with his adviser and committee, the student will develop a doctoral dissertation.

8. A Final Oral Examination, upon completion of the dissertation, is administered by the adviser and the Doctoral Committee.

9. Teaching, or the equivalent experiences, is required of all candidates for the Ph.D. in Business Administration. Fellowships, assistantships, and other financial aid from the School of Business Administration are not available to foreign students during their first year on this campus. An application from

a foreign student must be accompanied by a statement of financial sufficiency.

MASTER'S DEGREE PROGRAMS

All master's degree programs build upon a substructure of fundamental knowledge. In accordance with the accreditation guidelines of the AACSB, the foundation for master's study within the School consists of basic course work in economics, mathematics, statistics, computer methods, organizational behavior, accounting, finance, marketing, and the social and legal environment. Any baccalaureate degree holder may apply for admission to the master's degree program of the School. Applicants holding the baccalaureate degree in business typically satisfy most of the foundation requirements. Admittees having deficiencies in any of these areas are required to complete appropriate Foundation Courses prescribed from among the following: BA400, 406, 411, 422, 440, 447, 451, 456, and 457.

Standards for admission are consistent with those described earlier in this Bulletin. A minimum ATGSB score of 450 is required of all applicants (including foreign), but a higher score may be necessary depending upon the applicant's grade point average. (The Graduate Record Examination is not an acceptable substitute for the ATGSB.)

All master's degree candidates are required to demonstrate proficiency in written English. To this end one faculty member devotes his time. Noncredit course work and writing counseling is available to the student. The writing requirement is aligned with the student's regular course work writing requirements.

Students seeking entry into any graduate course may be required to demonstrate eligibility for such advanced study through a qualifying examination or by other means. Graduate and 400-level courses are open only to students meeting the usual admission requirements for graduate study.

A comprehensive examination is required of all students enrolled in master's degree programs of the School. This may be oral or written, depending upon the program involved.

Permission to present a thesis may be granted to qualified candidates enrolled in any of the masters programs. The thesis proposal must be approved by the end of the first semester of full-time graduate study. Up to 9 credit hours in lieu of course credit may be allowed for a thesis. An oral comprehensive examination is required upon completion of the thesis.

Description of the requirements for the various master's degree programs of the school are set forth below.

The Master of Business Administration Degree

The M.B.A. Program is oriented toward the development of general management knowledge and skills. The requirements for this degree follow:

1. Over and above the Foundation requirements noted above, candidates for the M.B.A. degree shall satisfactorily complete 30 semester hours of approved graduate study, 24 of which must be in courses designated as exclusively for graduate students.

2. All candidates shall complete the following courses: BA 711, 756, 722, 751, 706, 742, and 752.

3. At least three electives from among the 500-, 600-, and 700-level offerings of the School are required. Other electives may be chosen with the consent of the student's adviser.

The Master of Science in Business Administration Degree

This is a specialized degree program having several fields of concentration. The degree requirements in the various concentrations follow:

1. The M.S.B.A./Accounting Program

In addition to the foundation requirements described above, students not holding an undergraduate degree with a major in accounting shall take courses as prescribed by the School and providing a foundation in accounting appropriate to the student's career interests.

Candidates shall satisfactorily complete 30 semester hours of approved graduate study, 16 of which must be in courses designated as exclusively for graduate students.

The following five courses are required of all candidates: BA 704, 706, 712, one course in organizational behavior, and one course in quantitative methods, selected with the approval of the adviser.

At least five elective courses are chosen with the consent of the student's adviser. These may be selected so as to lead to specialization in various fields such as the following: managerial accounting, public accounting, information systems, accounting research and teaching, institutional accounting, and general accounting.

Highly qualified non-business majors may be granted privileges of an accelerated program, at the discretion of the School.

The CPA laws in Massachusetts and some other states, permit the holder of the master's degree to substitute the degree for part of the Public Accounting experience required for the certificate.

2. The M.S.B.A./Industrial and Personnel Relations Program

This program prepares students for careers in private and public organizations in personnel management, industrial relations, labor relations, and manpower affairs.

The industrial and personnel relations concentration requires a minimum of 30 semester hours of graduate study. Prerequisites for the program are those of all master's degree programs in this School. Students must complete these prerequisites before taking related 700-level courses and before completing their master's programs. Substitutions for prerequisite requirements may be made with the consent of the adviser. No thesis is required.

The following courses are required: BA 761, 762, 763, one course in Quantitative Methods (BA 756, 757, 805 (1), or equivalent) and one course in Behavioral Science (BA 751, 807 (1), or equivalent). Three industrial relations electives (9 credits) and two electives in management, economics, sociology, psychology, government, or related fields are chosen with the consent of the student's adviser.

3. The M.S.B.A./Management Science Program

This program is specifically designed for individu-

als who are interested in the application of quantitative techniques to the problems of business and administration. It is anticipated that persons with undergraduate training in engineering, mathematics, science, business, or economics will find this program appealing.

The number of credits necessary to complete the program is dependent upon previous preparation. Depending on the number of prerequisites already fulfilled, the program can involve between 30 and 51 credit hours. Thus, while it is possible to complete the program in a year, as a general rule one should plan to spend three or four semesters.

A key feature of this program is its flexibility in meeting the professional goals of the individual student. The program allows between six and eight elective courses. These electives allow the individual to develop considerable strength in specific disciplines or problem areas.

The following are required courses in the Management Science Program: BA 758, 759, 770, and 517.

In addition, 9 credit hours of electives in Quantitative Analysis and 9 credit hours of electives in the area of specialization are required.

An *Operations Research/Management Science Program* has been approved. It will be administered jointly by the School of Business Administration and the department of Industrial Engineering. The program will not grant degrees (each School will grant its own degrees). It is a formal recognition of long standing cooperation in an area which is of vital interest to both schools. We expect this formal recognition of cooperation to aid us in stimulating interest in operations research management science and to strengthen the offerings in both Schools.

4. The M.S.B.A./Marketing Program

The program prepares students for careers in marketing administration, sales management, product management, advertising management, marketing research, or wholesale/retail enterprise.

The Marketing concentration requires a minimum of 30 semester hours of graduate study. Prerequisites for this program are those of all master's degree programs in the School of Business Administration. *A thesis is required.*

The following courses are also required: BA 722, 723, 724, 725, one course in Quantitative Methods (BA 756, 757, or 805) and one course in Behavioral Science (BA 751, or 807), totaling 18 credits. In addition, a 6-credit master's thesis is required, along with two free electives (6 credits).

5. The M.S.B.A./Urban and Regional Management Program

The program prepares its graduates for careers in city and state government, community relations departments of business firms, business firms concerned with real estate and/or urban problems, research consulting firms, foundations, non-profit service organizations, and educational institutions.

This three-semester program of graduate study is designed to be flexible in order to meet the needs of students with different interests and abilities. A core of quantitative methods, behavioral science and management seminars forms the first semester. Thereafter, enough electives are available so that the student may develop skills and understanding in the

field of his choice. Specialization may be developed in the following areas:

- a. Urban Economic Planning.
- b. Real Estate and Housing.
- c. Research and Analysis.
- d. Transportation Planning & Policies.
- e. Other areas designed in cooperation with the program coordinator.

Sixteen of the *forty-five* hours required for the degree must be in courses designed exclusively for graduate students. As part of these 45 hours, all candidates for the degree must:

- a. Complete an independent work-study project approved by the program coordinator *OR*
- b. Present a thesis (6 to 9 credit hours allowed).

The requirements of the program are: BA 572, 782, 799, one course in Quantitative Methods (BA 756 or 757), and one course in Behavioral Science (BA 751 or 807).

In addition to the above 15 credit hours of required courses, the above-mentioned work-study project (or thesis) is required along with enough specialized electives (18 to 24 credits) to complete a total of 45 credit hours.

6. An M.S.B.A. with concentration in Finance is in the final planning stages. This will be a 30 credit-hour program.

GENERAL

The M.B.A. and M.S.B.A./Management Science degree programs are also offered on an evening basis in Pittsfield, Mass.

Questions concerning any of the graduate degree programs of the School should be addressed to Dean John T. Conlon, Director of Graduate Programs, School of Business Administration, University of Massachusetts, Amherst, Massachusetts 01002.

Application

Application for Graduate Study should be made directly through the Dean of the Graduate School, as described elsewhere in this Bulletin. A complete application consists of (a) the application form, (b) two references, (c) two sets of official transcripts of all college-level work, and (d) an official score report on the Admission Test for Graduate Study in Business (ATGSB). The Graduate Record Examination is not acceptable for admission. Information on the ATGSB may be obtained from the Educational Testing Service, 20 Nassau Street, Princeton, New Jersey 08540. Application deadlines are found elsewhere in this Bulletin. Action is taken immediately upon receipt by the Graduate School of a complete application.

Standards for admission are consistent with those described earlier in this Bulletin. A minimum ATGSB score of 450 is required, but a higher score may be necessary depending on the applicant's grade-point average. Foreign students are not exempt from this requirement. The present master's student average ATGSB score at this school is 524. This examination may be taken more than once. Recommended are use of one of the commercially available study guides, and taking the ATGSB as early as possible in order to allow time for retaking the exam with-

out delaying the admissions process. For applicants desiring entry in the Summer Session or fall semester, the ATGSB should be taken during the preceding November, or (at the latest) February. Applications for the ATGSB must be at the Educational Testing Service three weeks before the scheduled examination date.

Fellowships, assistantships, and other financial aid from the School of Business Administration are not available to foreign students during their first year on this campus. An application from a foreign student must be accompanied by a statement of financial sufficiency.

Program ABLE (Accelerated Business Leadership Education) is a 24-month program designed to identify and assist members of minority groups who have the potential to achieve the Master of Business Administration degree. Although there is an apparent need for top level minority managers and administrators to enter the mainstream of American business, our program is more concerned with the development of managers and administrators to service the growing needs of minority businessmen.

Candidates selected for this program must have a bachelor's degree or the equivalent from any college or university of recognized standing. Applicants must take the ATGSB (Admission Test for Graduate School of Business) in August or November. Applicants will be judged primarily on the basis of past academic achievement, ATGSB scores, and recommendations. Classes start June 1, therefore the deadline for all application materials (including ATGSB scores) is February 1. Decisions will be made by April 15.

Each person who qualifies for admission under Program ABLE is eligible for a fellowship to pursue the master's degree. The awarding of fellowships is based on need.

Students once selected are required to attend an intensive 12-week summer program on the campus of one of the ABLE consortium member schools. This summer program is designed to concentrate on areas where most students experience difficulties.

Following the summer session, the students return to enter the regular master's program at the School to which they have been admitted.

Further information on Program ABLE may be obtained from Dr. Lawrence Johnson, Assistant Dean, School of Business Administration.

ALL COURSES CARRY 3 CREDITS UNLESS OTHERWISE SPECIFIED

(Open to doctoral students only, except by special permission of the Director of Graduate Programs and the instructor.)

801. PHILOSOPHICAL FOUNDATIONS OF BUSINESS ADMINISTRATION.

Conceptual foundations of business administration in context of social and economic philosophy. Topics include corporate objectives and goal models, theories of organization, and social responsibilities of corporate management. Mr. O'Donnell.

802. BUSINESS ORGANIZATION AND ADMINISTRATIVE THEORY.

Investigation and critique of contemporary theories of organization, administration, and decision, with a view

of their scientific support and practicality for increasing rationality, prediction, and control in business administration. Mr. Finch, Mr. Litterer.

803. MANAGEMENT SYSTEMS: THEORY, ANALYSIS, AND DESIGN.

Review of systems with stress on normative behavioral systems. Designing, implementing, operating, maintaining, and controlling such systems. The organization viewed as a total system. The student designs a behavioral system as a class project. Mr. Young.

804. DECISION MODELS IN BUSINESS ADMINISTRATION.

Application of probability theory and selected topics in mathematics to stochastic and deterministic managerial decision models. Mr. Kaczka, Mr. Belovicz.

805. I, II. STATISTICAL ANALYSIS FOR BUSINESS RESEARCH.

Analysis of statistical theory and techniques relevant to business research and decision making. First semester: probability and distribution theory; second semester: decision theory and multivariate methods.

Credit, 3-6. Mr. Frederick.

806. SEMINAR IN QUANTITATIVE MANAGEMENT SCIENCE.

A presentation of journal reports on business topics utilizing a quantitative approach.

Credit, 3-6. Mr. Belovicz.

807. I, II. SEMINAR IN BEHAVIORAL SCIENCE.

Selection of relevant findings in the behavioral and social sciences regarding human organizational behavior and conversion into forms suitable for transmission and application in business administration.

Credit, 3-6. Mr. Finch, Mr. Litterer.

808. ADVANCED TOPICS IN BUSINESS ADMINISTRATION.

An advanced topic section is available in each general or functional field of study, to facilitate investigation of current literature and research effort in these areas.

Credit, 3-6.

809. INTERNATIONAL ASPECTS OF BUSINESS ADMINISTRATION.

The basis of international division of labor, the history of international business policy, and the cultural differences that affect the management of international business enterprises.

Credit, 3-5.

810. TUTORIAL STUDY IN BUSINESS ADMINISTRATION.

Individualized secondary or applied research in special areas of guided doctoral-level investigation. Permission of instructor required.

811. BUSINESS HISTORY.

American business institutions as they have evolved through time. The impact of social and economic processes on their development and operations.

812. JURISPRUDENCE AND BUSINESS.

Social-scientific and philosophical theories of law; the systems, functions, processes and limits of law, applications to the business organization in its external and internal affairs.

821, 822. ADVANCED TOPICS IN MANAGEMENT SCIENCE I, II.

Selected topics of current significance in mathematical, statistical, computer, and behavioral approaches to management and administration. Either semester may be elected independently.

Credit, 3-6. Mr. Balintfy.

823. MATHEMATICAL PROGRAMMING.

Application of linear, quadratic, integer, and dynamic programming models and algorithms in pricing and

resource allocation by firms; sensitivity analysis and parametric programming. Mr. Balintfy.

831. LONG RANGE BUSINESS PLANNING.
Advanced and intensive study of long-range planning practices in business firms. Emphasis on the planning process in relation to other managerial processes on the most recent methods of reducing risk and uncertainty in long-term planning strategies. Mr. Michael.

832. DYNAMICS OF CORPORATE ORGANIZATION.

Changes in corporate organization as adaptive responses to challenges and constraints imposed upon the corporation by variations in endogenous and exogenous factors. Mr. Michael.

841. MANAGEMENT INFORMATION THEORY.
Theories and applications of management information system in the context of total servomechanism system concept. Topics include the generation, organization, transformation, dissemination, codification, discrimination, and economics of information. Mr. Hare.

842. MANAGEMENT CONTROL SYSTEMS.
The function of total systems theory which provides direction in attaining planned objectives of the system. Various theories of control and measurement in relation to organization resources and information requirements. Mr. Hare.

851. THEORY AND SCIENCE IN MARKETING.
The state of marketing knowledge; the content and validity of marketing thought, theories, and other substantive and methodological contributions to the development of marketing science. Mr. Frederick.

852. SOCIAL SCIENCE ISSUES IN MARKETING.
Materials from the various social science disciplines that have been used to expand understanding of marketing; discernment of areas of ignorance about marketing involving social-science-related marketing phenomena.

861. ADVANCED ACCOUNTING THEORY.
The origin, development, and current status of accounting theory and its relationship to other disciplines and the needs of report users. Independent research required. Mr. Backer.

862. MANAGEMENT INFORMATION PROBLEMS.
Methods of research for establishing: 1) The behavioral impact of incremental differences in information, 2) The determinants of useful information for problem solving and their normative implications. Existing literature examined. Mr. Backer.

871. MICRO THEORY OF FINANCE.
Optimum financial policies and decisions of nonfinancial firms. Theory of competition and optimum asset management of financial firms. Prerequisite, 12 hours in finance and economics. Mr. Kumar.

872. FINANCIAL INTERMEDIARIES AND MARKETS.
Financial intermediaries and financial markets and the development of a theory of financial intermediation as it relates to growth, employment, and price levels. Mr. Choate.

881. PRODUCTION MANAGEMENT ANALYSIS.
Application of mathematical and statistical methods and models for production management decisions and problem analyses and for managerial planning and control. Mr. McGarrah.

882. PRODUCTION MANAGEMENT POLICY.
Formulation and administration and production and operations management policies with reference to developing an effective total business strategy. Mr. McGarrah.

891. MANPOWER PLANNING.
Investigation and comparative evaluation of systems of manpower planning both at the corporate and national levels, including systematic manpower inventory appraisal. Mr. Wortman.

892. LEGAL ASPECTS OF INDUSTRIAL AND LABOR RELATIONS.
The historical evolution of national labor policy from its English origin in 1349 through modern experiences. Common law, statutory, and constitutional developments of labor policy examined against a historical, political, and economic background.

900. DOCTORAL DISSERTATION. *Credit, 15.*
MASTER'S LEVEL COURSES IN BUSINESS ADMINISTRATION (BA)

(Open to graduate students only, for major or elective credit. Students seeking entry may be required to demonstrate eligibility for advanced study through a qualifying examination or by other means.)

700. PROBLEMS IN BUSINESS ADMINISTRATION.
Independent study and research on selected problems in business administration. Permission of instructor and the dean required. *Credit, 3-6 each semester.*

702. ACCOUNTING SYSTEMS.
Accounting systems and their relationship to other business information systems. Mr. Burch, Mr. Krzystofik.

703. ACCOUNTING THEORY.
Agreed and controversial criteria for collecting and reporting financial information. Examination of the professional literature. Mr. Backer, Mr. Simpson.

704. CONTEMPORARY ACCOUNTING ISSUES.
Investigation and analysis of selected contemporary issues in accounting with presentation of individual findings through discussion and reports. Mr. Backer.

705. SEMINAR IN ACCOUNTING.
Study and evaluation of current literature in accounting and related fields. Mr. Denner, Mr. Stone.

706. FINANCIAL MANAGEMENT.
Internal financial problems of firms; capital budgeting, cost of capital, dividend policy, rate of return, and the financial aspects of growth. Readings and cases. Mr. Barges, Mr. Ludtke.

707. GROWTH, MERGERS, AND ACQUISITIONS.
An analysis of the financial problems and implications of corporate growth. Mergers and acquisitions as instruments for achieving growth. Text and cases. Prerequisite, BA 706 or equivalent. Mr. Barges.

709. METROPOLITAN AND REGIONAL PLANNING.
The growth and decentralization of cities and the formation of metropolitan areas. Planning as applied to the metropolitan complex for various types of regions. Mr. Bacon.

711. ACCOUNTING IN MANAGEMENT.
Production and use of accounting and other quantitative data for decision making related to planning and control. Mr. Backer, Mr. Stone.

712. ADVANCED MANAGERIAL ACCOUNTING.
An advanced course in the use of accounting and other quantitative measurements for business planning, decision-making, and performance-evaluation. Prerequisite, BA 711 or permission of instructor.

722. MARKETING MANAGEMENT.
Marketing concepts of planning, organization, control,

and decision-making from the viewpoint of the business executive. Stress on tools available for analysis and control of marketing activities. Mr. Paul, Mr. Worthing.

723. MANAGEMENT SCIENCE IN MARKETING.

An analytical examination of the application of management-science techniques to marketing phenomena. Drawing upon the methodology of management science, the course analyzes the marketing problems facing a modern organization and examines the relationship of the behavioral and quantitative sciences to marketing. Prerequisites, BA 722 and 756, or permission of instructor.

724. RESEARCH METHODS IN MARKETING.

Applicability and utilization of quantitative research techniques to marketing problems and processes. Prerequisites, BA 722 and 756.

Mr. Frederick, Mr. Monroe.

725. PERSPECTIVES ON CONSUMER BEHAVIOR.

The social, psychological, and economic roles of the consumer in decision-making and market behavior. The external and internal determinants of buyer behavior. Prerequisite, BA 422 or equivalent.

726. INTERNATIONAL MARKETING MANAGEMENT.

The impact of political, social, economic and cultural forces of divergent societies upon the managerial decision-making process in international marketing operations. Problems associated with the design of marketing strategy.

Prerequisite, BA 732 or equivalent. Mr. Liander.

730. SEMINAR IN MARKETING PROGRAMS AND ISSUES.

Selected areas of pronounced and current interest in the field of marketing. Topics include marketing and public policy, buyer-behavior research, and marketing communications.

Prerequisite, BA 722 or equivalent. Mr. Buell, Mr. Paul.

735. RISK MANAGEMENT.

Analysis of risks to which a business is exposed, determination of methods of providing protection, including loss-prevention techniques, risk retention, self-insurance, and use of commercial insurance. Case and field studies.

Mr. Osborn.

740. MANAGERIAL ECONOMICS.

Application of microeconomic analysis to typical business decisions such as: cost and profit analysis; demand and pricing, investment analysis, and capital budgeting; and the uses of economic forecasting in business decisions. Prerequisite, one semester intermediate microeconomic theory.

742. OPERATIONS MANAGEMENT.

Analysis of production problems and solution techniques, applicable in industrial analysis.

751. ORGANIZATIONAL BEHAVIOR.

An examination through simulations, role play, and case study of the interaction of 1) organizational structure and process and 2) individual and group behavior. Emphasis on individual and group decision-making processes.

752. BUSINESS POLICY.

Capstone course requiring application of knowledge, theories, and techniques derived from previous courses, using integrative cases and empirical observations to formulate improved policies and plans.

754. MANAGEMENT SCIENCE TECHNIQUES IN ENVIRONMENTAL PLANNING.

Introduction to mathematical and computer methods and techniques useful in the description and control of en-

vironmental systems. Large scale computer models used to demonstrate the technique in analysis of selected representative problems. Mr. Kaczka.

755. GAME THEORY.

Zero and non-zero games including theory, solution technique; experimental literature based upon game theory. Prerequisites, BA 758 and BA 759.

756. QUANTITATIVE METHODS III.

Statistical methods employed in collection, analysis, and interpretation of data. Business applications of sampling, analysis of variance, experimental design, regression analysis, and forecasting models.

757. QUANTITATIVE METHODS IN BUSINESS ADMINISTRATION.

Application of probability theory (discrete and continuous), stochastic process, linear, quadratic and dynamic programming, waiting lines, sequencing, and computer simulation models to selected problems in management science. Mr. Corcoran, Mr. Kaczka.

758. DETERMINISTIC MODELS IN MANAGEMENT SCIENCE.

Introduction to deterministic models and techniques relevant to business problems. Topics include Kuhn-Tucker theory, mathematical programming, difference equations and discrete and continuous maximum principles.

759. PROBABILISTIC MODELS OF MANAGEMENT SCIENCE.

Introduction to probabilistic models and statistical techniques relevant to the understanding of business problems.

760. WORK STANDARDS AND JOB CLASSIFICATION.

The principles and basic requirements in evaluating and classifying job positions, in establishing and applying production standards, and in work simplification.

761. SEMINAR IN PERSONNEL MANAGEMENT.

Current practices and major problems of personnel administration through use of the case method and role-playing techniques.

Prerequisite, personnel management course. Mr. Young.

762. MANAGEMENT OF INDUSTRIAL RELATIONS.

Organization and administration of the industrial relations function within business firms. Emphasis on alternative approaches to management rights and responsibilities in labor relations.

Prerequisite, Management 644.

Mr. Conlon.

763. SEMINAR IN INDUSTRIAL RELATIONS.

Analysis of the major current problems encountered by business management in the negotiation and administration of labor relations agreements. A major research study is required.

Mr. Conlon.

765 (formerly 517). BEHAVIORAL-SCIENCE MODELS IN BUSINESS.

Behavioral-science theories and models as they apply to the behavioral problems of enterprises.

770. MANAGEMENT SCIENCE AND MANAGERIAL PLANNING AND CONTROL SYSTEMS.

Application of the methodology of management science to problems of design testing and evaluation of facilities usage, manpower organization, and information procedures actually employed by business firms or government agencies to execute socio/economic purposes of society.

Mr. Hare, Mr. McGarrah.

775 (formerly 520). INVESTMENTS.

Development of a general theory of investment management and its application to individual and institutional investors; computer portfolio management.

Mr. Cheng, Mr. Deets.

780. RESEARCH METHODS.

Fundamental concepts of the purpose and practice of scientific research, including formulation of research design and objectives, collecting, processing, and analyzing socio-economic data.

Prerequisite, BA 457 or equivalent.

781. SYSTEMS THEORY & URBAN PROBLEMS.

The fundamentals of systems theory and its application to urban problems. Various social-economic urban problems, and how systems theory can be utilized in effective solutions.

782. CURRENT ISSUES IN URBAN & REGIONAL MANAGEMENT.

A capstone course; an inquiry into man's urban and regional problems. Application of theories and analytical tools to urban and environmental issues and problems. Recent thinking and work in the field.

Permission of instructor required.

783. PUBLIC BUDGETING AND SYSTEMATIC ANALYSIS.

The theory and techniques of budgeting and systematic analysis and the political processes that relate these techniques to decision-making within governmental organizations.

788. LAND AND THE DEVELOPMENT OF COMMUNITIES.

Land and its use from ancient to modern times. Emphasis on the resource base and its importance as the intensity of land-use increases in the development of both rural communities and highly urbanized areas.

Mr. Bacon.

799. SEMINAR IN BUSINESS ADMINISTRATION.

The relationship of business and management to the environment in which they operate.

800. MASTER'S THESIS.

Credit, 9.

MASTER'S FOUNDATION COURSES

(Courses numbered in the 400 series are reserved exclusively for graduate students who are completing foundation deficiencies, and do not carry graduate degree credit. These courses are open only to students meeting master's degree admission requirements of the School.)

400. COMPUTER METHODS FOR BUSINESS.

Current and potential management usage of computers, basic computer programming, and computer-based information systems in management decision-making.

406. BUSINESS FINANCE.

Survey of principles and practices of financing business. Not open to students with undergraduate work in corporation finance.

Prerequisite, elementary accounting (through corporate accounts).

411. INTRODUCTION TO ACCOUNTING.

Principles underlying preparation of financial statements and the development and application of accounting data for planning and control.

Mr. Dennler.

422. MARKETING ENVIRONMENT.

Dimensions of change in social, economic, and political factors, related to efforts surrounding establishment and attainment of marketing policy and corporate objectives.

Mr. Buell, Mrs. Barber.

440. MANAGERIAL ECONOMICS.

Microeconomic analysis and application to business decisions such as: cost and profit analysis; demand and pricing; investment analysis and capital budgeting; and economic forecasting.

447. LAW AND GOVERNMENT.

An introduction to nature, functions, and limitations of state and non-state law-government systems, industrial jurisprudence, and politico-legal environment of business.

451. ADMINISTRATIVE BEHAVIOR.

Analysis of fundamental psychological and sociological phenomena that underlie group behavior; exploration of organization processes including leadership, communication, and change; analysis of classical decision and system theory.

456. QUANTITATIVE METHODS I.

Business applications of algebra including ratios, proportions, logarithms, partial fraction series, limits, convergence, combinations, and permutations. Basic concepts of differential and integral calculus, and matrix algebra.

Prerequisite, one semester of college algebra.

457. QUANTITATIVE METHODS II.

Laws and theories of probability and statistics, with applications in business and economics. Topics include probability models, sampling distribution, estimation, hypothesis testing, and decision theory.

COURSES OPEN TO BOTH GRADUATE AND UNDERGRADUATE STUDENTS

(For major or minor credit)

Accounting (ACCTG)

510. BUSINESS APPLICATIONS OF THE COMPUTER.

Intermediate and advanced computer programming applied to business problems. The COBOL language treated in depth, related to accounting problems. Also surveys the Computer application in areas such as simulation, PERT, and business gaming.

Prerequisites, Accounting 110 or COINS 121 or equivalent.

620. FINANCIAL REPORTING III.

The accounting problems of expanding and declining business enterprises. Emphasis on financial reporting problems of companies that expand by means of acquisition and merger, including foreign subsidiaries. Some coverage of accounting for special sales, procedures, and fiduciaries.

Mr. Gosman, Mr. Simpson.

635. INVENTORY CONTROL.

Mathematical modeling applied to control of inventory investments. Emphasis on the recognition of relevant costs for the development and solution of appropriate models.

Prerequisites, BA 759 or permission of instructor.

Mr. Corcoran.

680. C.P.A. PROBLEMS.

Extensive practice in solutions of problems from the accounting practice parts of recent C.P.A. examinations. Included are problem areas from cost, intermediate, advanced, and governmental accounting.

Mr. Lentilhon, Mr. O'Connell.

General Business and Finance (GB FIN)

504. MODELS OF FINANCIAL ANALYSIS AND MANAGEMENT.

An analytical approach to financial management. Emphasis on theoretical topics of financial decision-making. Through the use of mathematical, statistical, and com-

puter simulation methods, various financial decision-making models are made explicit in their assumptions, rigorous in their construction, and testable in their implications.

Prerequisites, Gen Bus 201 and elementary knowledge of mathematics, statistics, and programming.

Mr. Cheng, Mr. Kumar.

512. TOPICS IN FINANCIAL INSTITUTIONS AND MARKETS.

Intensive study of selected topics relating to financial institutions and markets with emphasis on management implications.

Prerequisite, Fin 210 or Econ 211.

521. SECURITY ANALYSIS.

Factors affecting investment values of securities, and methods used in their analysis. Mr. Cheng, Mr. Deets.

522. THEORY OF INVESTMENT PROCESSES.

An in-depth study of portfolio analysis and stochastic processes in security markets. Emphasis on quantitative solution techniques and testing procedures.

Prerequisites, Fin 220 and Fin 221 or permission of instructor.

Mr. Cheng, Mr. Deets.

545. METROPOLITAN TRANSPORTATION.

Analysis of economic, social, and technological developments on demand and supply factors for the movement of people and goods within urban areas. Determination of the optimal mix of modal facilities to maximize the total transport resources of the urban area. The coordination of internal and external transport systems.

Prerequisite, Gen Bus 240 or permission of instructor.

Mr. Rivers.

561. LAW II.

Sales, negotiable instruments and secured transactions; their economic functions and consequences.

Prerequisite, Gen Bus 260.

562. LAW III.

Economic functions and consequences of agency, partnerships and corporations.

563. LAW IV.

Legal problems most commonly encountered by certified public accountants with attention to the subjects currently being included in C.P.A. examinations.

Prerequisite, Gen Bus 260. Limited to Accounting majors only.

564. LAW OF URBAN DEVELOPMENT.

Legal problems generated by the changing urban environment. Topics include the law of race relations, poverty and welfare, land use planning, urban and regional planning.

Prerequisite, Gen Bus 260 or equivalent. Mr. Bonsignore.

569. (I), 570 (II). CITY PLANNING.

(Reg Pl 573, 574).

The historical and legal aspects of land use and regional development, and a critical examination of planning techniques used in guiding the physical growth of communities.

Credit, 3 each semester.

572. SEMINAR IN URBAN AND REGIONAL STUDIES.

Analysis of the dimensions of urban growth and change, discussion of the reasons behind, and the problems growing out of, the economic growth and stagnation of urban areas.

Prerequisite, Gen Bus 270, Econ 271, Econ 282, or permission of instructor.

573. INTRODUCTION TO SIMULATION METHODS (IE 573).

The principles and methods of computer simulation.

Each student expected to construct, test, and run a complex simulation model.

Mr. Kaczka.

574. REAL ESTATE FINANCE.

A problem-oriented course; financial practices, institutions, and methods of analysis related to real-estate investment. Topics include investment theory, taxation, and government programs.

Prerequisites, Fin 201, Gen Bus 270.

575. HOUSING ANALYSIS.

The urban housing market; government housing programs and practices of private enterprises analyzed and evaluated. A housing-market model is used for analysis. All students required to complete a project.

Prerequisite, Gen Bus 270 or equivalent.

658. QUEUEING-THEORY MODELS.

Development and application of models of waiting lines, including single- and multiple-channel and single- and multiple-stage queues for various priorities and queue disciplines.

Prerequisites, BA 758 and 759 and permission of instructor.

659. TIME-SERIES ANALYSIS.

Analysis of time-series and dynamic models for use in forecasting and control of business and economic systems.

660. ADVANCED METHODS OF COMPUTERIZATION IN NUTRITION AND FOOD SERVICE.

The mathematical foundations of computations with food nutrient and recipe data. The data file structure of computerized food and nutrient accounting systems. The principle of mathematical optimizations techniques and its utilization in computerized menu planning and scheduling models. Laboratory work with computer applications.

Prerequisite, NF 340, Management 110 and Math 115 or equivalents.

Mr. Balintfy.

Management (MGT)

510. MANAGERIAL APPLICATIONS OF COMPUTER PROGRAMMING.

Intermediate and advanced computer programming. Emphasis on problems in accounting and management information systems.

Prerequisite, Management 110 or permission of instructor.

534. WAGE AND SALARY ADMINISTRATION.

Objectives, procedures, and problems involved in establishment and administration of operative and executive compensation plans.

Mr. Wortman.

641. MANAGEMENT DECISION SIMULATION.

Participation in management of a firm in a simulated industry. Students, organized into management teams, apply their knowledge of business administration and economics in a competitive struggle for profit and market position.

644. MANAGEMENT-UNION RELATIONS I.

Comparison of union-management objectives, functions, and structures including scope and impact of union penetration into areas of managerial authority.

Mr. Conlon, Mr. Wortman, Mr. Carlisle, Mr. Bornstein.

645. MANAGEMENT-UNION RELATIONS II.

Problems in the interpretation and administration of collective-bargaining agreements studied by use of the case method of analysis.

Prerequisite, Management 644 or permission of instructor.

Mr. Conlon, Mr. Wortman, Mr. Carlisle, Mr. Bornstein.

Chemical Engineering

GRADUATE FACULTY

JOHN W. ELDRIDGE, *Head of the Department of Chemical Engineering and Professor*, B.S., Maine, 1942; M.S., Syracuse University, 1946; Ph.D., University of Minnesota, 1949.

KENNETH D. CASHIN, *Professor*, B.S., Worcester Polytechnic Institute, 1947; M.S., 1948; Ph.D., Rensselaer Polytechnic Institute, 1955.

DAVID C. CHAPPELEAR, *Adjunct Associate Professor*, B.E., Yale, 1953; Ph.D., Princeton, 1960.

JAMES M. DOUGLAS, *Professor*, B.S., Johns Hopkins, 1954; Ph.D., University of Delaware, 1960.

ROBERT S. KIRK, *Associate Professor*, B.S., Illinois Institute of Technology, 1943; M.S., Illinois Institute of Technology, 1943; Ph.D., University of Wisconsin, 1948.

JAMES R. KITTRELL, *Associate Professor*, B.S., Oklahoma State University, 1962; M.S., University of Wisconsin, 1963; Ph.D., 1966.

ROBERT L. LAURENCE, *Associate Professor*, B.S., Massachusetts Institute of Technology, 1957; M.S., University of Rhode Island, 1960; Ph.D., Northwestern, 1965.

ROBERT W. LENZ, *Professor*, B.S., Lehigh University, 1949; M.S., Institute of Textile Technology, 1951; Ph.D., State University of New York, 1956.

E. ERNEST LINDSEY, *Professor*, B.S., Georgia Institute of Technology, 1936; Ph.D., Yale, 1940.

THOMAS J. MCAVOY, *Associate Professor*, B.S., Brooklyn Polytechnic Institute, 1961; Ph.D., Princeton, 1964.

STANLEY MIDDLEMAN, *Professor*, B.S., Johns Hopkins, 1958; D. Eng., 1961.

LELAND H. S. ROBLEE, JR., *Professor*, B.S., Purdue, 1949; M.S., 1956; Ph.D., 1958.

W. LEIGH SHORT, *Professor*, B.S., University of Alberta, 1956; M.S., 1957; Ph.D., University of Michigan, 1962.

MARCEL VANPEE, *Professor*, B.S., M.S., University of Louvain, Belgium; Ph.D., 1940.

The graduate program in chemical engineering emphasizes advanced study in engineering fundamentals rather than specific technological applications. To be admitted to full graduate status in this field, either of the following requirements should be met:

1. Applicant must have a Bachelor's degree in chemical engineering from a recognized school, or
2. Applicant must show satisfactory academic training or demonstrate proficiency in these subjects as a minimum:

Mathematics: through Calculus.

Chemistry: through Organic and Physical.

Engineering Mechanics: Statics, Strength of Materials, Dynamics.

Chemical Engineering: Stoichiometry, Unit Operations.

Thermodynamics (including thermodynamics of chemical change).

Electrical Engineering: Elements of Circuits and Machines.

REQUIREMENTS FOR THE PH.D. DEGREE

In the Chemical Engineering Department, the Ph.D. candidate is required to successfully complete (with a grade of B or better) English 634, Advanced Technical Writing. The Department does not impose any other requirements beyond those established by the University Graduate School.

REQUIREMENTS FOR THE M.S. DEGREE

1. ChE 800, Thesis, 6–10 credits (may be research or design). If a student elects a nonexperimental thesis, he must otherwise demonstrate experimental proficiency or provide other evidence thereof, such as from industrial experience.

2. At least 12 credits of Chemical Engineering 700-level courses. ChE 662 may also be used toward meeting this requirement (*i.e.*, in lieu of 3 of these 12 credits).

3. Additional graduate-credit courses, chosen according to the student's interests from the fields of engineering, science, mathematics, and the humanities, to constitute the total requirement of 30 credits for the M.S. degree.

4. University-wide requirements as described on p. 31.

ALL COURSES CARRY 3 CREDITS UNLESS OTHERWISE SPECIFIED

COURSES OPEN TO GRADUATE STUDENTS ONLY (For either major or minor credit)

700. SPECIAL PROBLEMS. *Credit, 1–3.*

701. CHEMICAL ENGINEERING THERMODYNAMICS I.

Review of the fundamental laws of thermodynamics, P-V-T relations of fluids, thermodynamic functions, fluid flow, compression and expansion of gases, liquefaction and separation of gases.

Prerequisite, Ch E 126 or equivalent.

Mr. Roblee.

702. CHEMICAL ENGINEERING THERMODYNAMICS II.

Phase equilibria and chemical reaction equilibria and their applications in chemical processing.

Prerequisites, Chem 586 and Ch E 701.

Credit, 2. Mr. Vanpee.

703. CHEMICAL ENGINEERING ANALYSIS III.

Mathematical analysis of chemical engineering problems continued. Advanced matrix techniques, perturbation analysis, and analytical solutions to partial differential equations.

Prerequisite, Ch E 662.

Mr. Douglas.

705. CHEMICAL REACTOR DESIGN.

Principles of chemical reaction kinetics and their application to industrial chemical processes. Systems homogeneous and heterogeneous, batch and flow, catalyzed and uncatalyzed, isothermal and adiabatic.

Prerequisites, Chem 586, Math 186 or 541 or equivalent.

Mr. Kirk.

706. ADVANCED KINETICS AND REACTOR DESIGN.

Topics from the recent literature including reactions in gradients, catalysis and optimization of chemical reactors by methods of dynamic programming.

Prerequisites, Ch E 705 and Ch E 361 or equivalent. Mr. Kirk.

707. ADVANCED PROCESS CONTROL.

Theory of closed loop control. Use of LaPlace transforms and transfer functions; stability analysis, root-locus, Bode diagrams; frequency response and time response in controller design.

Prerequisite, Ch E 376 or equivalent. Mr. McAvoy.

708. PROCESS DYNAMICS.

Translating process performance into mathematical form, application to control system design. Fluid systems, thermal systems, mass transfer systems (distillation, drying), reaction kinetics.

Prerequisite, Ch E 707. Mr. Douglas.

710. APPLIED OPTIMIZATION IN CHEMICAL ENGINEERING.

Topics include non-linear programming, (Kuhn-Tucker theorem, quadratic programming), geometric programming, calculus of variations, dynamic programming, Pontryagin's Maximum Principle.

Prerequisite, Ch E 688. Mr. Novak.

711. CHEMICAL ENGINEERING FLUID MECHANICS.

Introduction to advanced work in chemical engineering fluid mechanics. Viscosity, momentum balances (Navier-Stokes equation), friction, turbulence, the motion of suspended solids in fluids, and non-Newtonian fluids.

Prerequisite, Ch E 256. Mr. Middleman.

712. CHEMICAL ENGINEERING HEAT TRANSFER.

Introduction to advanced work in heat transfer as applied to chemical engineering. Thermal diffusivity; energy balances; analytical, graphical, and numerical solutions to steady and transient problems; convection and radiation.

Prerequisite, Ch E 711. Credit, 2. Mr. Roblee.

713. ANALOG-HYBRID SIMULATION IN CHEMICAL ENGINEERING.

Topics in analog-hybrid simulation useful to students beginning research. Linear and non-linear components, magnitude and time scaling, digital logic, hybrid operation.

Mr. Novak.

714. POLYMER RHEOLOGY.

Definition and measurement of rheological properties; continuum mechanics and constitutive equations; molecular theories of polymer deformation; correlation and interrelation of material functions. Relation of the various approaches taken in describing the viscous and viscoelastic properties of polymers, evaluation of the utility of these approaches, and indication of the role of modern rheology in the characterization and processing of polymers.

Prerequisite, Ch E 711. Mr. Middleman.

715. COMBUSTION PHENOMENA.

Fundamentals of combustion. Combustion thermodynamics, Rankin-Hugoniot relations, propagation of explosions, laminar flames, turbulent flames, detonations, radiation processes, kinetics of combustion.

Prerequisites, Ch E 358 and 380. Mr. Vanpee.

716. MASS TRANSFER.

A unified treatment of mass transport phenomena, emphasizing scientific principles. Diffusional phenomena,

convective mass transfer and application of integral averaging techniques to mass transfer.

Prerequisite, Ch E 711. Credit, 2. Mr. Laurence.

731. ADVANCED MASS TRANSFER.

Mass transfer with emphasis on theory of diffusion. Molecular diffusion, multicomponent diffusion, convective mass transfer, diffusion with chemical reaction and chromatographic separations.

Prerequisites, Ch E 662 and 716. Mr. Laurence.

741. ADVANCED PROCESS DESIGN I.

Solution of advanced process design problems which require the use of principles covered in previous courses. The problems may be conceptual designs, economic decision-making in process design or engineering design calculations for a specific process.

Prerequisites, Ch E 256 and 382. Mr. Short.

800. MASTER'S THESIS.

A theoretical or experimental study of some chemical engineering problem. Credit determined by the work done, and by agreement with the Department and the Graduate Thesis Committee. Credit, 6-10.

801. ADVANCED TOPICS IN CHEMICAL ENGINEERING.

An in-depth exploration of the advanced aspects of an area pertinent to chemical engineering.

Prerequisites, Ch E 662, 712, and 716. Credit, 1-3.

802. ADVANCED TOPICS IN TRANSPORT PHENOMENA.

An in-depth exploration of a particular aspect of advanced transport phenomena.

Prerequisites, Ch E 662, 712, and 716. Credit, 1-3. Mr. Roblee.

803. ADVANCED TOPICS IN THERMODYNAMICS.

An intensive consideration of current literature and research in a particular area of thermodynamics.

Prerequisite, Ch E 702. Credit, 1-3. Mr. Short.

804. ADVANCED TOPICS IN KINETICS.

Selected topics from the current literature. Prerequisite, Ch E 705. Credit, 1-3. Mr. Kirk.

805. ADVANCED TOPICS IN PROCESS DYNAMICS AND CONTROL.

Topics from the current literature, discussed in depth.

Prerequisite, permission of instructor. Credit, 1-3. Mr. Douglas.

806. ADVANCED TOPICS IN CHEMICAL ENGINEERING ANALYSIS.

For advanced graduate students in chemical engineering. Application of mathematics to problems in chemical engineering. Specific topics vary according to instructor and student interests.

Prerequisites, Ch E 662, 703 or permission of instructor. Credit, 1-3. Mr. McAvoy.

807. ADVANCED PROCESS DESIGN II.

Continuation of Advanced Process Design I. Emphasis on more complex designs and the uses of mathematical models or optimization techniques in the solution of these design problems.

Prerequisites, Ch E 256, 257, and 688. Mr. Short.

900. DOCTORAL DISSERTATION.

A theoretical or experimental study of a chemical engineering problem. Credit determined by the work done and by agreement with the Department and the Graduate Thesis Committee. Maximum credit, 30.

COURSES OPEN TO BOTH GRADUATE AND UNDERGRADUATE STUDENTS
(For either major or minor credit)

660. AIR POLLUTION CONTROL PROCESSES.

Introduction to the techniques of air pollution control; particulate removal, wet and dry scrubbing processes, removal of selected species from gases (e.g. sulfur dioxide).

Prerequisites, Freshman chemistry and permission of instructor. *Credit, 2.* Mr. Short.

661. CHEMICAL ENGINEERING ANALYSIS I.

Application of mathematical techniques to chemical engineering problems. Emphasis on analysis of problems and the devising of satisfactory mathematical models. Machine computation with digital and analog devices.

Prerequisites, Ch E 256 and Math 256. Mr. Roblee.

662. CHEMICAL ENGINEERING ANALYSIS II.

Mathematical analysis of chemical engineering problems continued. Topics include: matrix methods, vector analysis, calculus of finite differences, numerical solution of ordinary and partial differential equations, complex variables and Laplace transformations. Emphasis on applying these techniques to real chemical engineering processes and on the physical and mathematical interpretation of the results.

Prerequisite, Ch E 661. Mr. Novak.

663, 664. SURVEY OF NUCLEAR ENGINEERING I, II.

Introduction to the principles of nuclear physics and a survey of problems involved in the design and operation of nuclear reactors. Heat transfer, shielding, metallurgy, controls, waste disposal, and health physics.

Two lectures, one laboratory period per week each semester.

Prerequisite, two semesters of physics and mathematics through integral calculus.

Credit, 3 each semester. Mr. Marcus.

670. APPLIED POLYMER SCIENCE.

A survey of the methods of preparing important synthetic polymers, and their properties and applications.

Prerequisite, undergraduate organic and physical chemistry. Mr. Lenz.

676. PROCESS CONTROL AND DYNAMICS.

Theoretical and practical factors governing automatic control of industrial processes. Topics include control systems, measurement devices, control modes, mathematical relationships, and laboratory work.

Prerequisites, Ch E 256 and Math 256. Mr. Novak.

684. PROCESS AND PLANT DESIGN.

Application of the principles of stoichiometry, unit operations, thermodynamics, and cost estimation to the design of chemical plants. The economic factors influencing the design are stressed. Lecture and laboratory.

Prerequisites, Ch E 256 and Ch E 381 or equivalent. Mr. Cashin.

688. OPTIMIZATION.

Fundamental ideas and application of optimization techniques in operation and design. Topics include: extrema of functions, effect of constraints, Lagrange multipliers, introduction to linear programming, geometric programming and dynamic programming.

Prerequisite, Math 187. Mr. Novak.

689. OPTIMIZATION USING VARIATIONAL TECHNIQUES.

Application of the calculus of variations, Pontryagin's maximum principle, and dynamic programming to the design and control of chemical process equipment. Systems described by both ordinary and partial differential equations are considered. Topics include optimal reactor design, the synthesis of optimal control systems, and optimal periodic operation of processing units.

Prerequisite, Math 187. Mr. Douglas.

COURSES NOT FOR MAJOR CREDIT

(No graduate credit given for students majoring in Chemical Engineering)

685, 686. SPECIAL PROBLEMS.

Individual study of a selected problem for qualified students. By arrangement with members of the department. *Credit, 1-3.*

Chemistry

GRADUATE FACULTY

WILLIAM E. McEWEN, *Head of the Department of Chemistry and Professor*, B.A., Columbia, 1944; M.A., 1945; Ph.D., 1947.

RONALD D. ARCHER, *Professor*, B.S., Illinois State at Normal, 1953; M.S., 1954; Ph.D., Illinois, 1959.

RAMON M. BARNES, *Assistant Professor*, B.S., Oregon State, 1962; M.A., Columbia, 1963; Ph.D., Illinois, 1966.

JOHN F. BRANDTS, *Professor*, B.A., Miami, 1956; Ph.D., Minnesota, 1961.

PAUL E. CADE, *Associate Professor*, B.S., Texas, 1954; Ph.D., Wisconsin, 1961.

GEORGE W. CANNON, *Director of Graduate Studies and Professor*, B.A., Dakota Wesleyan University, 1939; M.A., Illinois, 1941; Ph.D., 1943.

LOUIS A. CARPINO, *Professor*, B.S., Iowa State College, 1950; Illinois, 1951; Ph.D., 1953.

JOHN A. CHANDLER, *Associate Professor*, B.S., Ohio, 1955; M.S., Illinois, 1958; Ph.D., 1959.

JAMES C. W. CHIEN, *Professor*, B.S., St. John's, 1949; B.A., Wayland College, 1950; M.S., Kentucky, 1951; Ph.D., Wisconsin, 1954.

DAVID J. CURRAN, *Associate Professor*, B.S., Massachusetts, 1953; M.A., Boston College, 1958; Ph.D., Illinois, 1961.

JOHN W. GEORGE, *Associate Professor*, B.A., Princeton, 1948; M.A., North Carolina, 1950; Ph.D., M.I.T., 1958.

STEPHEN S. HIXSON, *Assistant Professor*, B.A., Pennsylvania, 1965; Ph.D., Wisconsin, 1970.

ROBERT R. HOLMES, *Professor*, B.S., Illinois Institute of Technology, 1950; Ph.D., Purdue, 1954.

CLIFFORD P. LILLYA, *Associate Professor*, B.A., Kalamazoo College, 1959; Ph.D., Harvard, 1964.

WILLIAM J. MACKNIGHT, *Associate Professor*, B.S., Rochester, 1958; M.A., Princeton, 1963; Ph.D., 1964.

EARL J. McWHORTER, *Associate Professor*, B.S., Rensselaer Polytechnic Institute, 1950; Ph.D., Cornell, 1955.

BERNARD MILLER, *Professor*, B.S., C.C.N.Y., 1951; M.A., Columbia, 1953; Ph.D., 1955.

JOHN W. OLVER, *Assistant Professor*, B.S., Rensselaer Poly. Institute, 1955; M.S., Tufts, 1956; Ph.D., Massachusetts Institute of Technology, 1961.

JOHN L. RAGLE, *Professor*, B.S., California (Berkeley), 1954; Ph.D., State College of Washington, 1957.

MARVIN D. RAUSCH, *Professor*, B.S., Kansas, 1952; Ph.D., 1955.

MARION B. RHODES, *Assistant Professor*, B.S., Connecticut, 1958; M.S., Massachusetts, 1960; Ph.D., 1966.

GEORGE R. RICHASON, JR., *Associate Head of Department of Chemistry and Professor*, B.S., Massachusetts, 1937; M.S., 1939.

JOHN E. ROBERTS, *Professor*, B.S., New Hampshire, 1942; M.S., 1944; Ph.D., Cornell, 1947.

ROBERT L. ROWELL, *Associate Professor*, B.S., State Teachers College at Bridgewater, Mass., 1954; M.S., Boston College, 1956; Ph.D., Indiana, 1960.

SIDNEY SIGGIA, *Professor*, B.S., Queens College, 1942; M.S., Brooklyn Polytechnic Institute, 1943; Ph.D., 1944.

J. HAROLD SMITH, *Professor*, B.S., Utah, 1936; M.S., 1938; Ph.D., Wisconsin, 1941.

RICHARD S. STEIN, *Professor*, B.S., Brooklyn Polytechnic Institute, 1945; M.S., Princeton, 1948; Ph.D., 1949.

THOMAS R. STENGLE, *Associate Professor*, B.S., Franklin & Marshall College, 1951; M.S., Michigan, 1953; Ph.D., 1961.

HOWARD D. STIDHAM, *Associate Professor*, B.S., Trinity College, 1950; Ph.D., Massachusetts Institute of Technology, 1955.

PETER C. UDEN, *Associate Professor*, B.S., Bristol, 1961; Ph.D., 1964.

ROBERT M. WILLIAMS, *Assistant Professor*, B.A., Dartmouth, 1951; M.S., New Hampshire, 1953; Ph.D., Iowa State, 1958.

JOHN S. WOOD, *Associate Professor*, B.A., Keele, 1958; Ph.D., Manchester, 1962.

OLIVER T. ZAJICEK, *Assistant Professor*, B.S., Baldwin-Wallace, 1950; M.S., Wayne State, 1958; Ph.D., 1961.

The chemistry department offers programs leading to the M.S. and Ph.D. degrees in analytical, inorganic, organic, and physical chemistry and in interdisciplinary areas. In addition, the department actively participates in the Five College Ph.D. Program.

During their first year doctoral students are expected to complete qualifying requirements in the four areas of chemistry (or certain cognate areas). Qualification requires the demonstration of competence at the advanced undergraduate or beginning graduate level. It can be accomplished by formal course work or by examination. Students fulfill the Ph.D. comprehensive examination requirement by passing a series of cumulative examinations in their specialty. All doctoral candidates are required to pass a departmental examination showing that they have a reading knowledge of German, Russian, or Japanese sufficient to understand journal literature.

In order to allow each student's program to be tailored as closely as possible to individual needs, the department has few formal course requirements for the doctoral degree. On entrance, the student is assigned an adviser who helps plan the initial program. After the student has selected a research topic,

the research adviser helps plan the remainder of the course program.

M.S. degree candidates must qualify in three areas in their first year. Thirty credits of graduate work must be presented; 10 of these are awarded for the thesis. The course of study is planned by the student and the adviser. No language or cumulative examinations are required. An acceptable research thesis must be presented and defended.

The M.S. degree may be awarded to doctoral candidates after they have satisfied all Ph.D. qualifying and cumulative examination requirements and requirements of the Graduate School.

Students accepted into graduate programs are expected to have undergraduate preparation comparable to that recommended by the American Chemical Society. Those who have not fulfilled these requirements may be admitted as special students or provisional students until the deficiencies have been removed. All entering graduate students take placement examinations in the week prior to the beginning of the first week of graduate study. These are designed to evaluate the student's preparation and assist in planning a course of study. When a student elects an interdisciplinary research problem, an individual program of courses and examination requirements may be worked out to satisfy special needs. For example, the chemistry department has a close association with the Polymer Science and Engineering Program and many graduate students pursue interdisciplinary work in the two areas.

ALL COURSES CARRY 3 CREDITS UNLESS OTHERWISE SPECIFIED

COURSES OPEN TO GRADUATE STUDENTS ONLY (For either major or minor credit)

701. ADVANCED ANALYTICAL CHEMISTRY.

Special laboratory work to meet the needs of the individual student.

Prerequisite, Chem 513 or equivalent. *Credit, 1-5.*

706. APPLIED ANALYTICAL CHEMISTRY.

The application of basic analytical principles and techniques to the solution of actual analytical problems. The interrelationship between the diverse analytical approaches, as applied to organic, inorganic, qualitative, and quantitative problems.

Prerequisite, Chem 513. *Mr. Siggia.*

710. ELECTROANALYTICAL CHEMISTRY.

Principles of electrochemistry and their relation to the newer electroanalytical methods.

Prerequisite, Chem 513 or equivalent. *Mr. Curran, Mr. Olver.*

715. SPECTROANALYTICAL CHEMISTRY.

Theory and practice of modern methods of chemical analysis based upon spectroscopic measurements of atoms and molecules in solid, liquid, gas, and plasma states. Includes x-ray, optical, and radio frequency absorption and emission techniques.

Prerequisite, Chem 513 or equivalent. *Credit, 4. Mr. Barnes.*

716. CHEMICAL SEPARATION METHODS.

Methods of chemical analysis using separatory techniques. Theory of separations and practical treatment of chromatographic methods, liquid-liquid extraction, precipitation, distillation, electrical and membrane separations.

Prerequisite, Chem 513 or 515 or permission of instructor. *Credit, 4. Mr. Uden.*

741. INORGANIC PREPARATIONS LABORATORY.
Preparation and testing of various types of inorganic substances, to teach important techniques and give familiarity with the reactions and properties of inorganic materials.
Credit, 3-5.

742. INORGANIC CHEMISTRY OF THE LESS FAMILIAR ELEMENTS.

Lectures and collateral reading on the descriptive chemistry of some of the less familiar elements such as boron, gallium, indium, thallium, the lanthanides, fluorine, titanium, vanadium, tantalum, tungsten, and uranium, with correlations between structure or spatial configurations and chemical properties.

747. STRUCTURAL INORGANIC CHEMISTRY.

Applications of principles of spectroscopy, magnetic resonance, and dielectrics toward an understanding of structural aspects of inorganic substances in the gas, liquid, and solid states. Discussion of symmetry, stereochemically non-rigid molecules, metal carbonyl compounds, hydrogen bonding, unusual coordination compounds, solid state effects.

Prerequisite, Chem 546 or equivalent. Mr. Holmes.

748. COORDINATION CHEMISTRY.

Molecular orbital bonding theory, spectroscopy, magnetism, stereochemistry, and reaction mechanisms as applied to coordination species. Emphasis on transition elements.

Prerequisite, Chem 546 or equivalent. Mr. Archer.

756. TOPICS IN INORGANIC CHEMISTRY.

Topics such as coordination chemistry, non-aqueous solvents, less familiar oxidation states, acid base theories, reaction mechanisms, etc.

Prerequisite, Chem 546 or equivalent.
Credit, 2 each semester. Maximum credit, 6.

760. ORGANIC REACTION MECHANISMS.

Continuation of Chem 571. A detailed survey of the basic organic reactions in terms of the relationship between structure and reactivity. Mechanistic presentation brings each topic up-to-date on the basis of current work.

Prerequisite, Chem 571 or permission of instructor.

761. PHYSICAL ORGANIC CHEMISTRY.

Application of theory and physical principles to problems of structure, spectroscopy, and reactivity of organic molecules. Topics include molecular orbital theory, symmetry conservation, kinetics, linear free energy relationships, and isotope effects.

Prerequisite, Chem 571; corequisite, Chem 590 or permission of instructor.

765. ADVANCED ORGANIC CHEMISTRY LABORATORY.

Discussion and laboratory work involving experimental techniques of research and design of experiments. Syntheses of compounds desired for research and use of the original literature.

Prerequisite, a year course in organic chemistry.
Credit, 1-5.

770. HETEROCYCLIC CHEMISTRY.

The chemistry of the common organic heterocyclic compounds containing nitrogen, oxygen, and sulfur. Consideration of mechanisms of the reactions discussed.

Prerequisite, Chem 571 or equivalent. Mr. McEwen.

771. ORGANOMETALLIC CHEMISTRY

The chemistry of compounds containing carbon-metal and carbon-metalloid bonds. Preparation, structure, physical properties, chemical reactions, and synthetic applications of organometallic derivatives. Topics of current interest stressed.

Prerequisite, Chem 571 or equivalent. Mr. Rausch.

772. CHEMISTRY OF NATURAL PRODUCTS.

Natural products of current interest, primarily from the steroid, terpene, and alkaloid groups. Emphasis on structural proofs, stereochemistry, synthesis, and biogenetic relationships.

Prerequisite, Chem 571 or permission of instructor.
Mr. McWhorter.

775. SPECIAL TOPICS IN ORGANIC CHEMISTRY.

One to three topics of current interest discussed in detail. Recent development of theoretical and/or synthetic importance to organic chemistry. Topics covered in recent years include photochemistry, perfluoro compounds, organonitrogen and organosulfur chemistry.

Prerequisite, Chem 571 or permission of instructor.
Maximum credit, 6.

776. ORGANIC SYNTHESIS.

Important synthetic reactions, with stress on recent developments in methods of organic synthesis. Develops the student's ability to propose his own syntheses of complex molecules. Organic reaction mechanisms as guides to the development of new synthetic reactions and to criticism of proposed syntheses.

Prerequisite, Chem 571 or permission of instructor.

785. STATISTICAL THERMODYNAMICS.

Introduction to statistical thermodynamics. Applications of Microcanonical, Canonical, Grand Canonical, and Generalized Ensembles to chemical systems. Calculation of thermodynamic functions from spectroscopic data, fluctuations, imperfect gases, nearest neighbor lattice statistics, and other topics of current interest.

Prerequisite, Chem 595 or equivalent. Mr. Stidham.

787. CHEMICAL SPECTROSCOPY, TECHNIQUE AND APPLICATIONS.

Introduction to the elementary theory, experimental techniques, and interpretation of data obtained in applications of infrared, Raman, visible, ultraviolet, nuclear quadrupole and nuclear magnetic resonance spectroscopy to the solution of chemical problems.

Prerequisite, Chem 586 or equivalent.

Mr. Stengle, Mr. Stidham.

788. CHEMICAL SPECTROSCOPY THEORY.

Introduction to the theory of infrared, Raman, visible and ultraviolet, nuclear quadrupole and nuclear magnetic resonance spectroscopy.

Prerequisites, Chem 787 and permission of instructors.

Mr. Stidham, Mr. Stengle.

791, 792. QUANTUM CHEMISTRY.

Quantum mechanics and its application to chemical problems. The exact theory of structure of simple atoms, the application of approximate methods for complex atoms and molecules, the chemical bond, resonance, the interaction of radiation and matter, group theory.

Prerequisite, Chem 546 or equivalent.
Credit, 3 each semester. Mr. Cade, Mr. Ragle.

793, 794. X-RAY CRYSTALLOGRAPHY.

Crystal symmetry, the diffraction of x-rays and the powder method as a tool for identification and determination of unit-cell constants. Intensities and some factors affecting them; space groups and systematic extinctions; single crystal diffraction methods; refinement of crystal structures; methods of obtaining trial structures.

Prerequisite, Chem 281 or equivalent.

Credit, 3 each semester.

795. TOPICS IN PHYSICAL CHEMISTRY.

Prerequisites, Chem 595 and 546 or equivalent.

Credit, 2 each semester. Maximum credit, 6.

797. ORGANIC POLYMERIZATION REACTIONS

Mechanisms, kinetics, and thermodynamics of principal types of polymerization reactions and their relationship to the properties of resulting polymers.

Prerequisite, Chem 166 or equivalent. Mr. Lenz.

798, 799. PHYSICAL CHEMISTRY OF HIGH POLYMERS.

Structure of solid polymers, determination of molecular

weights, sizes and shapes, mechanical properties of solid polymers, colligative properties of polymer solutions, polyelectrolytes, and physical chemistry of proteins.

Prerequisite, Chem 785 or equivalent.

Credit, 3 each semester. Mr. Stein, Mr. MacKnight.

891. SEMINAR.

Conference, reports or lectures.

Credit, 1 each semester. Maximum credit, 2.

895. RESEARCH PROBLEM.

Students prepare two proposals for research problems primarily involving library research, not directly related to the thesis topic, if the latter has been selected.

Credit, 4.

800. MASTER'S THESIS.

Credit, 10

900. DOCTORAL DISSERTATION.

Credit, 30.

COURSES OPEN TO BOTH GRADUATE AND UNDERGRADUATE STUDENTS

(For either ma, or or minor credit)

513. INSTRUMENTAL ANALYSIS.

Theory and practice of modern analyses utilizing optical, electrical, and thermal properties. Selected modern separation methods may be included.

Two class hours, one 4-hour laboratory period.

Prerequisites, Chem 210 and 586.

515. THEORY OF ANALYTICAL PROCESSES.

Topics such as chemical equilibrium, precipitate formation, chelating agents, multistage separation, etc., having general applicability in chemical investigations.

Three class hours, laboratory optional (1 extra credit).

Prerequisites, Chem 166 and 586. *Credit, 3-4.*

516. CHEMICAL MICROSCOPY.

Optics of the microscope, micrometry, microscopic study of fibers, crystals, physicochemical phenomena, qualitative analysis, and an introduction to electron microscopy.

Prerequisite, Chem 513 or permission of instructor.

Two 3-hour laboratory periods. *Credit, 2.* Mr. Roberts.

517. MICROQUANTITATIVE ANALYSIS.

Quantitative determination of carbon, hydrogen, oxygen, nitrogen, sulfur, halogens, phosphorous. Both organic and inorganic compounds included in microgram scale analyses.

Prerequisite, Chem 513 or permission of instructor.

One 4-hour laboratory period. *Credit, 1.* Mr. Meade.

519. ELECTRONICS INSTRUMENTATION FOR SCIENTISTS.

Laboratory-oriented course. Begins with electronic principles and leads through servo-systems, operational amplifiers, digital circuits, and other measurement devices. Two 3-hour laboratory periods.

Prerequisites, one year of physics and permission of instructor. Mr. Barnes, Mr. Curran.

544. RADIOCHEMISTRY.

Character of atomic nuclei, nuclear reactions, radiation and its detection, and techniques for the study and utilization of radionuclides.

Three class hours, one 3-hour laboratory period.

Prerequisite, Chem 210 or 127 or permission of instructor. *Credit, 4.* Mr. Richason.

546. THEORETICAL INORGANIC CHEMISTRY.

Survey of theoretical aspects of inorganic chemistry chosen from such topics as electronic structure and its relation to periodic properties, chemical bonding, molec-

ular structure, coordination chemistry, acid-base theory, non-aqueous systems, and reaction mechanisms.

Prerequisite, Chem 585.

547. INORGANIC CHEMISTRY OF THE COMMON ELEMENTS.

The chemistry of the common elements and their compounds, based on the periodic relationships and modern concepts of structure and bonding. An optional 2-credit, six-hour laboratory session provides an introduction to inorganic laboratory techniques and practices.

Prerequisite, Chem 546 or permission of instructor.

Credit, 3-5.

571. ADVANCED ORGANIC CHEMISTRY.

An intensive survey. Covers basic fundamentals and brings the student up-to-date on current work. Includes electronic effects, stereochemistry and a thorough consideration of the effect of structure on physical and chemical properties. Includes a detailed mechanistic study of some of the more important organic reactions. Prerequisite, one year of organic chemistry or permission of instructor.

572. IDENTIFICATION OF ORGANIC COMPOUNDS.

Identification of unknowns, both single compounds and mixtures of organic compounds, by their reactions, preparation of derivatives, spectra, and other physical properties. Two class hours, two 3-hour laboratory periods.

Prerequisites, one year of organic chemistry and permission of instructor. *Credit, 4.*

590. ADVANCED PHYSICAL CHEMISTRY.

Survey of modern physical chemistry emphasis on fundamentals of quantum mechanics and statistical mechanics. For students not taking further advanced work in these areas.

Prerequisite, Chem 586.

595. ADVANCED PHYSICAL CHEMISTRY.

Topics such as chemical thermodynamics, statistical mechanics, introductory quantum chemistry, and theories of gases, liquids, and solids.

Prerequisite, Chem 586.

COURSES NOT FOR MAJOR CREDIT

(No graduate credit for students majoring in chemistry)

561, 562. ORGANIC CHEMISTRY.

Introduction to the chemistry of carbon compounds. Survey of the principal classes of organic compounds and their reactions with emphasis on the relation of structure and reactivity.

Prerequisite, Chem 112.

Credit, 3 each semester.

563, 564. ORGANIC CHEMISTRY LABORATORY.

Application of the experimental techniques of organic chemistry to the preparation, purification, and identification of organic compounds.

One 3-hour laboratory period.

Concurrent enrollment in Chem 561, 562 required.

Credit, 1 each semester.

580. ELEMENTARY PHYSICAL CHEMICAL LABORATORY.

One 3-hour laboratory period.

Concurrent enrollment in Chem 582 required.

Credit, 1 Mr. Stengle.

581. ELEMENTARY PHYSICAL CHEMISTRY

Basic principles of physical chemistry designed for students with a limited mathematical background. Not open to chemistry majors.

Prerequisites, Chem 112, Physics 142, and Math 124.

Mr. Stengle.

582. ELEMENTARY PHYSICAL CHEMISTRY.

Continuation of Chemistry 581.

Two class hours.

Credit, 2. Mr. Stengle.

585, 586. PHYSICAL CHEMISTRY.

Fundamental theories and laws of physical chemistry.
Prerequisites, Math 174 and Physics 142.

Credit, 3 each semester.

587, 588. PHYSICAL CHEMISTRY LABORATORY.

Experience in modern physicochemical techniques. Concurrent enrollment in Chem 585, 586, required.

Credit, 2 each semester. Mr. Stidham, Staff.

Civil Engineering

GRADUATE FACULTY

MERIT P. WHITE, *Commonwealth Head of the Department of Civil Engineering and Professor*, B.A., Dartmouth, 1930; C.E., 1931; M.S.C.E., California Institute of Technology, 1932; Ph.D., 1935.

CLAYTON ADAMS, *Associate Professor*, B.S., U.S. Naval Academy, 1947; Nav. Eng., Massachusetts Institute of Technology, 1952.

DONALD D. ADRIAN, *Associate Professor*, B.A., Notre Dame, 1957; B.S., 1958; M.S., California at Berkeley, 1959; Ph.D., Stanford University, 1964.

ROBERT R. ARCHER, *Professor*, B.S., Massachusetts Institute of Technology, 1952; Ph.D., 1956.

STANLEY M. BEMBEN, *Associate Professor*, B.S., Massachusetts, 1956; M.S., Illinois, 1958; Ph.D., Cornell, 1966.

BERNARD B. BERGER, *Professor*, B.S., Massachusetts Institute of Technology, 1935; M.S., Harvard, 1948.

WILLIAM W. BOYER, *Professor*, B.S.C.E., North Carolina State, 1947; M.S.C.E., 1950.

CHARLES E. CARVER, JR., *Professor*, B.S.C.E., Vermont, 1947; M.S.C.E., Massachusetts Institute of Technology, 1949; D.S., 1955.

ALEXANDER CHAJES, *Associate Professor*, B.S.C.E., Cooper Union, 1952; M.S.C.E., Polytechnical Institute, 1955; Ph.D., Cornell, 1964.

JOSEPH M. COLONELL, *Associate Professor*, B.S.C.E., Colorado, 1958; M.S.C.E., Washington State, 1960; Ph.D., Stanford, 1966.

FRANCIS A. DIGIANO, *Assistant Professor*, B.S.C.E., Massachusetts, 1964; M.S.C.E., Tufts, 1965; Ph.D., Michigan, 1969.

FREDERICK J. DZIALO, *Associate Professor*, B.S.C.E., Massachusetts, 1954; M.S.C.E., 1957; Ph.D., Rensselaer Polytechnic Institute, 1965.

TSUAN H. FENG, *Professor*, B.S.C.E., Pei-Yang University, China, 1940; M.S.C.E., Wisconsin, 1946; Ph.D., 1950.

GERALD W. FOESS, *Assistant Professor*, B.S.E., University of Michigan, 1964; M.S.E., 1965; Ph.D., 1968.

JAMES HALITSKY, *Associate Professor*, B.M.E., City College of New York, 1940; M.A.E., New York University, 1952; Ph.D., 1970.

DENTON B. HARRIS, *Assistant Professor*, B.S.C.E., Massachusetts, 1952; M.S.C.E., 1953.

KARL N. HENDRICKSON, *Professor*, B.S.C.E., Maine, 1938; B.S.C.E., 1939; M.S.C.E., 1941.

WILLIAM E. HERONEMUS, *Professor*, B.S., United States Naval Academy, 1941; M.S., Massachusetts Institute of Technology, 1948.

GEORGE R. HIGGINS, *Associate Professor*, B.S.C.E., New Hampshire, 1948; M.S., Massachusetts Institute of Technology, 1951.

LAWRENCE N. KUZMINSKI, *Assistant Professor*, B.A., Toronto, 1962; M.S., 1964; Ph.D., Massachusetts, 1967.

PETER A. MANGARELLA, *Assistant Professor*, B.S.C.E., Carnegie-Mellon University, 1965; M.S.C.E., Stanford, 1966; Ph.D., 1970.

JOSEPH S. MARCUS, *Associate Dean and Professor of Civil Engineering*, B.S.Ch.E., Worcester Polytechnic Institute, 1944; M.S.C.E., Massachusetts, 1954.

MELTON M. MILLER, JR., *Associate Professor*, B.S.C.E., Vermont, 1955; M.S.C.E., Purdue, 1958; Ph.D., 1964.

WILLIAM A. NASH, *Director of Graduate Studies and Professor*, B.S.C.E., Illinois Institute of Technology, 1944; M.S., 1946; Ph.D., Michigan, 1949.

ELMER C. OSGOOD, *Professor*, C.E., Rensselaer Polytechnic Institute, 1928; Eng.D., 1931.

PAUL W. SHULDINER, *Professor*, B.S.C.E., University of Illinois, 1951; M.S.C.E., 1953; Eng.D., California, Berkeley, 1961.

KENNETH H. STOKOE II, *Assistant Professor*, B.S.C.E., University of Michigan, 1966; M.S.C.E., 1967; Ph.D., 1971.

FRED D. STOCKTON, *Associate Professor*, B.S.C.E., Alabama, 1942; M.E., Brown, 1949; Ph.D., 1953.

ROSCOE F. WARD, *Associate Professor*, B.A., College of Idaho, 1953; B.S.C.E., Oregon State College, 1959; M.S., Washington State University, 1951; D.S., Washington University, 1964.

LEE A. WEBSTER, *Assistant Professor*, B.C.E., University of Delaware, 1963; M.S., University of Illinois, 1965; Ph.D., 1968.

The Department offers the Ph.D. and Master of Science degrees in civil engineering, in environmental engineering, and in ocean engineering. The degrees in civil engineering are normally restricted to candidates with undergraduate engineering training. Details on the environmental engineering and ocean engineering programs are found elsewhere in this section under those headings. The requirements for the Master of Science in Civil Engineering degree are 30 graduate credits, 6 of which may be for a thesis, and enrollment in one of the following options: Environmental Engineering, Fluid Mechanics, Solid Mechanics, Soil Mechanics and Foundations, Structures, and Transportation Engineering.

Each option contains a core of either four or five required courses. The general requirements for the degree of Doctor of Philosophy with a major in civil engineering are those specified by the Graduate School. In addition, three approved courses in the humanities and/or social sciences (including foreign languages) must be completed with grades of C or better.

ALL COURSES CARRY 3 CREDITS UNLESS OTHERWISE SPECIFIED

COURSES OPEN TO GRADUATE STUDENTS ONLY

700. SPECIAL PROBLEMS.

Credit, 3-6.

710. TRANSPORTATION ANALYSIS AND PLANNING.

Analysis of traffic and transportation engineering problems in highways, railroads and airports and the planning related to those facilities.

Prerequisite, permission of instructor.

Mr. Shuldiner, Mr. Webster.

715. PAVEMENT DESIGN.

The theory of flexible and rigid pavement design: soil conditions, joints, base and subgrade material and mix.

Mr. Boyer.

716. TRANSPORTATION DESIGN.

Design of the visible features of rural and urban roadways and intersections.

Mr. Boyer, Mr. Webster

720. THEORETICAL SOIL MECHANICS.

The behavior of soil masses subjected to such forces as seepage, frost and imposed loads.

Mr. Stokoe.

721. APPLIED SOIL MECHANICS.

Solution of case problems applying the principles of soil mechanics to the design of embankments, retaining walls, footings, raft foundation, and pile structures.

Prerequisite, CE 720. Mr. Bemben, Mr. Hendrickson.

722. SEEPAGE ANALYSIS.

Analytical study of ground water and seepage problems related to earth structures.

Mr. Hendrickson.

723. SHEAR STRENGTH OF SOILS.

Survey of current theory and research.

Mr. Bemben.

724. SUBMARINE SOIL MECHANICS AND FOUNDATION ENGINEERING (OE 761).

Exploration of marine sediments, the assessment of the geotechnical properties and methods for altering the properties of marine sediments; submarine slope stability; foundation design factors for structures on and in marine sediments.

Prerequisite, CE 220.

Mr. Bemben.

730. PLASTIC STEEL DESIGN.

Plastic analysis and design of steel frames.

Prerequisites, CE 331 and 532.

Mr. Osgood.

731, 732. CIVIL ENGINEERING ANALYSIS I, II.

Mathematical and computational methods for the solution of civil engineering problems. Topics include equilibrium problems in continuous systems and the solution of related self adjoint boundary value problems in one or more space variables; vibration and stability problems, orthogonal functions, and eigenvalue problems; propagation problems in discrete and continuous systems.

Prerequisite: mathematical background covering topics in advanced engineering mathematics.

Credit, 3 each semester.

734. NUMERICAL METHODS IN STRUCTURAL MECHANICS.

Application of numerical methods to the solution of problems of structural mechanics. Finite difference techniques and other methods for the solution of problems in the vibration, stability, and equilibrium of structural elements.

Prerequisite, Math 585, introductory computer programming, or permission of instructor.

Mr. Miller, Mr. Stockton, Mr. Archer.

737. COASTAL STRUCTURES (OE 764).

Factors influencing the loading, performance, and dura-

bility of coastal structures. Design of waterfront structures including breakwaters, piers, and bulkheads. Design of submerged, large diameter, reinforced concrete cylindrical and spherical shells in shallow water.

Prerequisites, CE 333 and 532.

Mr. Osgood.

738. ANALYSIS AND DESIGN OF OFFSHORE STRUCTURES (OE 765).

Structural design of offshore structures such as buoys, towers, bridges, artificial islands, tunnels, and other special structures. Functional design considerations and methods of construction.

Prerequisites, CE 559, 534, and 540.

Mr. Miller.

741. STRUCTURAL DYNAMICS.

Behavior of linear and non-linear mechanical systems subjected to periodic forces, to non-periodic forces and to shock loads.

Mr. Chajes, Mr. Dzialo, Mr. Nash, Mr. White.

742. EXPERIMENTAL STRESS ANALYSIS.

Experimental procedures for determination of stresses and strains due to static and dynamic loads.

Mr. Harris.

743. ELASTICITY.

General equations of the mathematical theory of elasticity in space. Plane strain and plane stress in cartesian, polar, and general orthogonal coordinates.

Mr. Archer, Mr. Dzialo, Mr. Nash.

744. THEORY OF PLATES.

Classical theory of plates as well as modern developments. Relationship of the general theory of elasticity to plate theory.

Mr. Dzialo, Mr. Nash.

745. STRUCTURAL STABILITY.

Linear and non-linear buckling of columns, frames plates and shells; elastic, inelastic, and finite deformation theories. Exact solutions and approximate solutions by energy and finite difference methods.

Mr. Chajes, Mr. Nash.

746. SEISMIC ANALYSIS OF STRUCTURES.

Principles of engineering seismology including the analysis and design of structures to resist earthquake motions.

Prerequisite, CE 741.

Mr. Chajes, Mr. Dzialo, Mr. Nash, Mr. White.

747. STRUCTURAL DYNAMICS II.

A continuation of CE 741. Emphasis on analysis of civil engineering structures subject to various steady state and transient loadings.

Prerequisite, CE 741.

Mr. Chajes, Mr. Dzialo, Mr. Nash, Mr. White.

748. STRUCTURAL SHELLS.

Analysis of structural shells. Membrane theory, bending theory of shells of revolution, shear deformation shell theory, non-linear theories, stability.

Prerequisite, permission of instructor.

Mr. Archer, Mr. Nash.

751. FLUID MECHANICS OF THE OCEANS

(OE 711).

An introduction to geophysical fluid dynamics. Emphasis on interactions between the oceans and the atmosphere.

Prerequisites, CE 556 and 559.

Mr. Colonell, Mr. Mangarella.

752. OCEAN WAVE THEORY (OE 712).

Classical theory of water waves, generation and propagation of waves at sea, observation and recording of waves, wave spectra and sea forecasting, tsunami propagation and detection.

Prerequisites, CE 559 and 556.

Mr. Colonell.

763. SUBSURFACE HYDROLOGY.

Interrelation of surface and subsurface hydrology. Saturated and unsaturated flow in permeable media. Development and utilization of subsurface waters. Chemical, bacteriological, and physical aspects of ground water quality. Deep well liquid wastes disposal.

Prerequisite, CE 660 or permission of instructor.

Mr. Adrian.

764. COASTAL ENGINEERING (OE 777).
Estuary and coastline hydrodynamics. Emphasis on environmental considerations in the planning, design, and operation of engineering works in coastal waters.
Prerequisite, CE 559 or permission of instructor.

Mr. Colonell.
770. ENVIRONMENTAL ENGINEERING DESIGN.
Selection, evaluation, and design of environmental engineering processes and systems based on laboratory evaluations and pilot plant studies.
Prerequisites, CE 771 and 772. Mr. Lindsey.

771. UNIT PROCESSES OF ENVIRONMENTAL ENGINEERING.
Application of biological processes in environmental engineering: aerobic and anaerobic biological oxidation. Design of aeration and disinfection subsystems.
Prerequisite, CE 669 and 670. Mr. Lindsey.

772. UNIT OPERATIONS OF ENVIRONMENTAL ENGINEERING.
Application of physical and chemical processes in environmental engineering: sedimentation, flotation, filtration, adsorption, ion exchange, drying and chemical coagulation.
Prerequisites, CE 669 and 670. Mr. DiGiano.

773. AIR SAMPLING AND ANALYSIS.
Applications of fluid mechanics and gas laws to measurement and collection of gaseous atmospheric pollutants including those which are injurious to health. Manual and automated analysis of these pollutants by electrochemical, spectrophotometric and gravimetric techniques.
Prerequisite, Public Health 632 or permission of instructor. Mr. DiGiano, Mr. DiNardi.

774. ADVANCED WASTE TREATMENT.
Application of new techniques for treatment of wastewater with the ultimate objective of providing closed-cycle use. Methods of removing nonbiodegradables and inorganics from wastewater using physical and chemical processes.
Prerequisites, CE 771 and 772. Mr. DiGiano.

775. ENVIRONMENTAL SYSTEMS SIMULATION.
Theoretical and practical factors governing simulation in environmental engineering systems. Mathematical models of water resources, water supply, waste treatment and disposal systems.
Prerequisites, Math 187 and CE 270. Mr. Adrian.

776. BIO-INSTRUMENTATION OF ENVIRONMENTAL SYSTEMS.
Instrumentation and analytical techniques for research on biological, biochemical, and chemical systems influencing man's environment. Spectral theory and absorption spectroscopy, chromatographic and mass spectrographic analysis, automatic analysis instruments.
Prerequisite, CE 672 or equivalent. Mr. Kuzminski.

780. MECHANICS OF MATERIALS.
Advanced topics related to the mechanical behavior of structural materials. Mr. Harris.

781. MATERIALS FOR SUBMARINE STRUCTURES (OE 731).
The response of materials subjected to high compressive loadings in the sea water medium; theory of deformation and fracture under high compressive stress; brittle-ductile transition in materials; stress corrosion, corrosion fatigue.
Prerequisite, CE 580. Mr. Harris.

783. STRUCTURAL MECHANICS OF DEEP SUBMERSIBLE VEHICLES (OE 763).
Elastic and inelastic action of pressure hull structure for

deep submersible vehicles. Presentation of design criteria for stiffened shells and plating common to such systems.
Prerequisites, CE 141 (MAE 246) or CE 240.

Mr. Nash, Mr. Dzialo.
792. DEEP OCEAN SYSTEMS ENGINEERING AND DESIGN II (OE 772).

A continuation of systems engineering applied to deep ocean systems (CE 591). The class, organized and operating as a multidisciplinary engineering team, executes engineering and design for one or more complete systems.
Three class hours, one 3-hour laboratory period.
Prerequisite, CE 591. Credit, 4. Mr. Heronemus.

793. PUBLIC POLICY AND THE USE OF THE SEAS (OE 773).
Policies of the United States and other nations toward possession and use of the seas. Laws and agreements relating to jurisdiction in the marine frontier. Use of continental shelf, world-wide navigation systems, exploitation of natural resources, pollution of the oceans.
One class hour. Credit, 1. Mr. Heronemus.

794. FUNDAMENTALS OF NAVAL ARCHITECTURE (OE 774).
Vehicle buoyancy and stability. Vehicle resistance and production of thrust. Motion of surfaced and submerged bodies. Vehicle maneuvering and control. Towing and mooring line analysis.
Three class hours, one 3-hour laboratory period.
Credit, 4. Mr. Adams, Mr. Heronemus.

795. OCEAN ENGINEERING FIELD LABORATORY I (OE 775).
Introduction to oceanographic measurements and field operations related to waves, currents, seawater characteristics, materials durability, and marine instrumentation techniques. Preliminary design of field engineering project.
Prerequisite, completion of Ocean Engineering core curriculum. (Summer only.)

796. OCEAN ENGINEERING FIELD LABORATORY II (OE 776).
Design, fabrication, installation, and evaluation of instrumentation involved in ocean engineering. Emphasis on development of practical engineering approaches to problems in the ocean environment.
Prerequisite, CE 795. (Summer only.)

850, 851. SEMINAR.
Presentation by the graduate student of selected current literature and research. Visiting lecturers. One class hour.
Credit, 1.

800. MASTER'S THESIS. Minimum Credit, 6.

900. DOCTORAL DISSERTATION.

COURSES OPEN TO BOTH GRADUATE AND UNDERGRADUATE STUDENTS
(For either major or minor credit).

522. SOIL TESTING.
Sampling and testing of soils for engineering purposes. One class hour, two 3-hour laboratory periods.
Prerequisite, CE 220 or equivalent. Mr. Bemben.

523. SOIL MECHANICS FOR TRANSPORTATION ENGINEERING.
Application of the principles of soil mechanics to the field of Transportation Engineering. Topics include evaluation of the stability of soils as subgrade and embankment materials, the role of the subgrade properties of soils on the design of pavements, and methods for improving the subgrade properties of soils.
Prerequisite, CE 220. Mr. Bemben.

532. **THEORY OF STRUCTURES II.**
Analysis of statically indeterminate structures.
Prerequisite, CE 230. Mr. Osgood.
534. **THEORY OF STRUCTURES III.**
Analysis of complex or special structures.
Prerequisite, CE 232; corequisite CE 331 and 333.
Mr. Miller, Mr. Osgood.
535. **MATRIX ANALYSIS OF STRUCTURES.**
Development and use of the flexibility and stiffness methods of matrix analysis for determinate and indeterminate structures.
Prerequisite, CE 232. Mr. Chajes.
540. **STRENGTH OF MATERIALS II.**
Calculation of stresses and strains in components of machines and structures.
Prerequisite, CE 141.
Mr. Chajes, Mr. Dzialo, Mr. White.
556. **INTRODUCTION TO HYDRODYNAMICS.**
Mathematical treatment of basic theorems of classical hydrodynamics: potential flow, conformal mapping, wave and vortex motion. Practical application of hydrodynamic principles to engineering problems.
Prerequisite, Math 186 or permission of instructor.
Mr. Carver, Mr. Colonell.
559. **ENGINEERING OCEANOGRAPHY (OE 510).**
Fluid mechanics problems of ocean and coastal engineering including currents, tides, surface waves, tsunami and seiche phenomena, and coastal processes.
Prerequisite, CE 257 or permission of instructor.
Mr. Colonell, Mr. Mangarella.
561. **OPEN-CHANNEL FLOW.**
Steady flow in open channels including channel transitions and controls, sediment transport, and elementary design of related hydraulic structures.
Prerequisite, CE 260. Mr. Higgins, Mr. Mangarella.
575. **ATMOSPHERIC DISPERSION OF POLLUTANTS.**
Physical and dynamical properties of the atmosphere and their effect on dispersion of air-borne material. Methods of calculation of concentration fields in simple and complex flowfields. Practical approaches to the analysis of diffusion from point, jet, and urban area sources. Review of research techniques for measuring diffusion parameters.
Prerequisite, Math 174. Credit, 2. Mr. Halitsky.
581. **MATERIALS IN THE OCEAN. ENVIRONMENT (OE 530).**
The response of structural materials to the ocean environment. Theories of corrosion, abrasion, erosion, and biological attack.
Prerequisite, Marine Sci 525. Mr. Harris.
590. **ENGINEERING DESIGN OF OCEAN SYSTEM PAYLOAD DEVICES (OE 570).**
Techniques for augmentation of man's ability to measure, test, and synthesize the ocean environment through the development of tethered, towed, or stationary equipment. Topics include underwater photography, lighting, manipulative and prosthetic devices, data-gathering equipment, and underwater equipment design.
Prerequisite, Marine Sci 525.
591. **DEEP OCEAN SYSTEMS ENGINEERING AND DESIGN I (OE 571).**
Systems engineering applied to analysis and synthesis of systems capable of doing useful work in the deep oceans. Emphasis on design of deep-submergence vehicles. Three class hours, one 3-hour laboratory period.
Credit, 4. Mr. Heronemus.
605. **ADVANCED SURVEYING.**
Elements of astronomical, geodetic, and photogrammetric surveying; coordinate systems and map projections. Two class hours, one 3-hour laboratory period.
Prerequisite, CE 101. Mr. Boyer, Mr. Weidmann.
611. **TRAFFIC ENGINEERING.**
Engineering solutions to planning, design, and operations problems of urban and rural street and highway networks.
Two class hours, one 3-hour laboratory period.
Prerequisite, CE 210. Mr. Boyer, Mr. Webster.
634. **ADVANCED TOPICS IN CONCRETE.**
Design of various types of reinforced concrete-building frames; elastic theory and ultimate strength procedures.
Prerequisites, CE 232 and 333.
Mr. Miller, Mr. Osgood.
657. **THEORY OF HYDRAULIC SIMILITUDE.**
Hydraulic similitude, dimensional analysis, methods of obtaining dynamic similarity in hydraulic models in actual practice, analysis of typical hydraulic models.
Prerequisite, CE 257. Mr. Carver.
660. **HYDROLOGY.**
The hydrologic cycle, including precipitation, runoff, ground water, flood routing, reservoir sedimentation, water law, and applications of hydrologic techniques to water resources engineering.
Prerequisite, CE 260 or permission of instructor.
Mr. Higgins.
662. **WATER RESOURCES ENGINEERING.**
Planning and design of dams, reservoirs, and other related hydraulic structures, including analysis of existing and proposed water resources projects.
Prerequisite, CE 260 or permission of instructor.
Mr. Higgins.
665. **ENVIRONMENTAL INSTITUTIONS AND POLICIES.**
Public policies and laws relating to the use and conservation of water, air, land resources. Analysis of environmental-related governmental organizations at the federal, state, and local levels.
Prerequisite, permission of instructor.
Mr. Adrian, Mr. Berger.
669. **ENVIRONMENTAL ENGINEERING TECHNOLOGY.**
The technology available to provide clean air, clean water, and to dispose of solid waste. Some field trips to see environmental effects, treatment plants, and quality-monitoring stations.
One 4-hour laboratory (or field trip) and one 1-hour lecture.
Prerequisite, permission of the instructor. Credit, 2.
670. **ADVANCED ENVIRONMENTAL ENGINEERING PRINCIPLES.**
The underlying physical, chemical, and biological principles involved in engineering studies of air, water, and solid-waste pollution problems are developed. Basic concepts are combined to model pollution-control systems and responses of the atmospheric, aquatic, and terrestrial environments.
Prerequisite, permission of instructor. Mr. DiGiano.
671. **INDUSTRIAL WASTE TREATMENT AND CONTROL.**
Composition of industrial effluents; pollution criteria and effects of industrial wastes on receiving waters; physical, chemical, and biological methods and applications in treatment.
Two class hours, one 3-hour laboratory period.
Prerequisite, permission of instructor. Mr. Lindsey.
672. **ENVIRONMENTAL ENGINEERING ANALYSIS I.**
An application of chemical principles to environmental engineering analysis with specific reference to pollution indices.

Two class hours, one 3-hour laboratory period.
Prerequisite, Chem 112. Mr. Kuzminski.

673. ENVIRONMENTAL ENGINEERING ANALYSIS II.

The fundamental microbiological and biochemical properties of the microorganisms important in environmental engineering practice. Two class hours, one 3-hour laboratory period.

Prerequisite, CE 672 or permission of instructor.
Mr. Kuzminski.

674. RADIOLOGICAL HEALTH ENGINEERING.

Basic principles and procedures pertaining to the safe control, use, and disposal of common sources of ionizing radiation.

675. SURFACE WATER QUALITY CONTROL.

Evaluation and control of water quality in streams, lakes, and reservoirs. Mathematical analyses of patterns of water movement and their relation to water quality.
Prerequisite, permission of instructor.

Mr. Feng.

676. SOLID WASTES.

Production, collection, transportation, treatment, and disposal of solid waste products (including municipal, industrial, and agricultural wastes).
Prerequisite, permission of instructor.

Mr. Kuzminski.

COURSES NOT FOR MAJOR CREDIT

(No graduate credit for students majoring in Civil or Environmental Engineering)

520. SOIL MECHANICS.

Engineering uses and mechanical properties of soils.
Two class hours, one 3-hour laboratory period.

Mr. Hendrickson.

571. INTRODUCTION TO ENVIRONMENTAL POLLUTION CONTROL.

Basic engineering aspects of environmental pollution control.

Mr. Ward.

Environmental Engineering Program

GRADUATE FACULTY

(See under listed fields for degrees, institution and years.)

TSUAN H. FENG, *Director of the Program and Professor of Civil Engineering and Food and Agricultural Engineering.*

DONALD DEAN ADRIAN, *Associate Professor of Civil Engineering.*

LAWRENCE L. AMBS, *Assistant Professor of Mechanical and Aerospace Engineering.*

BERNARD B. BERGER, *Director of Water Resources Research Center and Professor of Civil Engineering and Public Health.*

JOSEPH M. COLONELL, *Associate Professor of Civil Engineering.*

SALVATORE R. DINARDI, *Assistant Professor of Public Health.*

FRANCIS A. DIGIANO, *Assistant Professor of Civil Engineering.*

GERALD W. FOESS, *Assistant Professor of Civil Engineering.*

JAMES HALITSKY, *Associate Professor of Civil Engineering.*

GEORGE R. HIGGINS, *Associate Professor of Civil Engineering.*

LAWRENCE N. KUZMINSKI, *Assistant Professor of Civil Engineering.*

E. ERNEST LINDSEY, *Professor of Chemical Engineering.*

PETER A. MANGARELLA, *Assistant Professor of Civil Engineering.*

HOWARD A. PETERS, *Associate Professor of Public Health and Civil Engineering.*

W. LEIGH SHORT, *Professor of Chemical Engineering.*

MARCEL VANPEE, *Professor of Chemical Engineering.*

ROSCOE F. WARD, *Assistant Dean of the School of Engineering and Associate Professor of Civil Engineering (on leave 1972-1973).*

The Environmental Engineering Program offers both M.S. and Ph.D. degrees. The overall objective of the Program is to prepare students for careers in engineering related to development of a better environment. This requires an understanding of water, air, and solid-waste treatment and disposal inasmuch as the processing of waste in one medium usually results in transfer of a by-product to one or both of the other media. Accordingly, the Environmental Engineering Master of Science curriculum requires each student to take a common core of fundamentals in the three media, while allowing him to pursue a subsequent specialty, in consultation with his adviser and in keeping with his career goals. The Ph.D. program has considerable flexibility to accommodate students who have been trained in various related or unrelated disciplines.

REQUIREMENTS FOR THE MASTER'S DEGREE

1. The Environmental Engineering Core.

Courses in the Core are intended to provide students from many different backgrounds with a technical foundation for more advanced environmental engineering courses, as well as an understanding of the institutions and policies common to control of water and air quality and land usage. The core consists of the following:

Civil Engineering 665, 669, 670, 850, 851, and one environmental engineering laboratory course (CE 672, 673, 770, 773, 776). Total Core Credits 13.

2. At least three courses listed in the Areas of Specialization.

Beyond the Core, environmental engineering elective courses have been conveniently grouped into three descriptive areas—systems, design, and science—each of which includes offerings in water, air and land resources. These are listed below:

Systems: CE 660, 662, 675, 764, 775, and Agricultural and Food Economics 582.

Design: CE 671, 676, 770, 771, 772, 774, Chemical Engineering 660, and Mechanical and Aerospace Engineering 577.

Science: CE 575, 672, 673, 674, 773, 776, and Public Health 632.

3. Thesis (6 credits) or Special Problem (3 credits).

4. Additional graduate credit courses which intensify a student's professional career goals. These

are available in the fields of Engineering, Chemistry, Computer Science, Geology, Marine Science, Microbiology, Public Health, Statistics, Regional Planning, and Zoology. For example, rather than electing the more traditional environmental engineering program of study, a student may elect one reflecting an interest in environmental management by taking 9 credits in Regional Planning and/or Economics.

5. All general Graduate School requirements for admission and for the degree must be met. A total of 31 credits must be earned.

REQUIREMENTS FOR THE PH.D. DEGREE

1. Forty-eight credits of approved graduate-level course work beyond the bachelor's degree, of which two minor areas provide a minimum of 18 credits. Suitable minor areas include:

- Chemical, Biological, or Physical Science.
- Mathematics, Computer Science, or Statistics.
- Chemical Engineering or Agricultural Engineering.
- Systems analysis, which may include courses offered in Industrial, Chemical, Electrical, and Mechanical Engineering.
- Public Health or Environmental Science.
- Economics, Planning, and Management.

2. In lieu of the language requirement, three approved courses in either the humanities and/or social sciences (including foreign languages) must be completed with grades of C or better. These need not be taken before the preliminary comprehensive examination.

3. 30 credits of dissertation.

INDIVIDUALS WITH NON ENGINEERING BACKGROUNDS

Although the program is administered by the Department of Civil Engineering, non-engineers are encouraged to apply. Students with degrees from any of the following disciplines are eligible: engineering, physical sciences, natural sciences, social sciences, and public health.

Those with non-civil engineering backgrounds are required to attain a certain level of proficiency in the following areas:

- Mathematics through Analytical Geometry and Calculus (Math 174) and one of the following courses: Comp Sci 251, Math 187, 233, or 343.
- General Chemistry (Chem 111 and 112).
- Introductory Physics (Physics 161 and 162).
- Static (CE 140).
- Fluid Mechanics (CE 257).
- Fluid Mechanics Laboratory* (CE 258).
- Engineering Hydraulics* (CE 260).

More detailed information may be secured from the program director.

* Not required for air pollution majors in the M.S. program.

Ocean Engineering

GRADUATE FACULTY

(See under listed fields for degrees, institution, and years.)

JOHN W. ZAHRADNIK, *Coordinator of Program and Professor of Mechanical and Aerospace Engineering.*

CLAYTON R. ADAMS, *Associate Professor of Civil Engineering.*

STANLEY M. BEMBEN, *Associate Professor of Civil Engineering.*

CHARLES E. CARVER, JR., *Professor of Civil Engineering.*

JOSEPH M. COLONELL, *Associate Professor of Civil Engineering.*

DUANE E. CROMACK, *Associate Professor of Mechanical and Aerospace Engineering.*

FREDERICK J. DZIALO, *Associate Professor of Civil Engineering.*

DENTON B. HARRIS, *Assistant Professor of Civil Engineering.*

WILLIAM E. HERONEMUS, *Professor of Civil Engineering.*

FRANCIS S. HILL, JR., *Assistant Professor of Electrical Engineering.*

CHARLES E. HUTCHINSON, *Professor of Electrical Engineering.*

ERNEST E. LINDSEY, *Professor of Chemical Engineering.*

PETER A. MANGARELLA, *Assistant Professor of Civil Engineering.*

MELTON M. MILLER, JR., *Associate Professor of Civil Engineering.*

RICHARD V. MONOPOLI, *Professor of Electrical Engineering.*

WILLIAM A. NASH, *Professor of Civil Engineering.*

ELMER C. OSGOOD, *Professor of Civil Engineering.*

JOHN E. RITTER, *Associate Professor of Materials Engineering.*

G. ALBERT RUSSELL, *Associate Professor of Mechanical and Aerospace Engineering.*

G. DALE SHECKELS, *Professor of Electrical Engineering.*

FRED D. STOCKTON, *Associate Professor of Civil Engineering.*

IAN B. THOMAS, *Assistant Professor of Electrical Engineering.*

Ocean engineering is that activity which combines knowledge of the ocean with engineering skill to utilize the oceans, their contents and boundaries, for the achievement of human objectives. Research in ocean engineering at the University of Massachusetts was initiated in 1967 with the award of a Project THEMIS (Department of Defense) contract totaling \$720,000 for four years.

The Ocean Engineering Program is administered as a degree-granting subdivision of the Civil Engineering Department; however, the administrative mechanism provided preserves the interdisciplinary nature of ocean engineering as an objective of academic pursuit. Present programs lead to the Master of Science in Ocean Engineering and Doctor of Philosophy degrees.

Programs leading to the degree of Master of Science in Ocean Engineering are designed to promote

understanding of the ocean environment while developing greater competence in a field of engineering applicable to ocean-oriented technical problems. The holder of this degree will have attained a general knowledge of ocean technology as it pertains to engineering endeavors. In addition to this breadth of knowledge he will have gained sufficient depth in his chosen professional specialty to approach ocean problems with confidence.

Doctoral study programs in ocean engineering have been designed to prepare individuals for high-level professional careers in academic, governmental, or industrial situations. Substantially greater competence in ocean technology is required of doctoral candidates, but professional breadth has not been sacrificed to attain this goal. Although the research leading to the doctoral dissertation assumes a predominant role in the study program, the problem-oriented character of professional engineering is preserved in selection of the research topic. Upon completion of an approved course of study, award of the doctoral degree indicates that the candidate has demonstrated excellence in a field of engineering which has significant relevance to ocean technology and that he has acquired sufficient knowledge of oceanic processes to utilize his specialty with due regard for the ocean environment.

To aid the definition of requirements for the degree programs described above, the formal courses available to students of ocean engineering are classified according to whether they are "core" or "specialty" courses. The course requirements for each degree are prescribed in terms of a "core curriculum" and, in addition, one or more groups of courses which combine to form areas of specialized knowledge, or "specialties," in an ocean engineering study program.

The core curriculum is a group of basic courses that will normally be required of every degree candidate in ocean engineering. The purpose of the core curriculum is to establish a base of knowledge which permits and encourages further study and eventual specialization.

At least ten "specialties" are available among the ocean engineering courses:

1. Acoustics
2. Applied physical Oceanography
3. Energy Storage and Conversion
4. Marine Corrosion and Materials Engineering
5. Marine Propulsion
6. Navigation, Control, and Information Processing
7. Ocean Structures and Marine Foundations
8. Ocean Systems Engineering and Design
9. Operations Research for the Ocean Environment
10. Systems for Aquacultural Engineering

Each specialty represents an area of specialized knowledge which is supported by courses from one or more of the traditional disciplines of engineering and science. Proficiency in at least one of the available specialties is required of candidates for the degree of Master of Science in Ocean Engineering. Doctoral candidates are required to pursue at least one specialty in considerable depth, and proficiency in a second area is encouraged. The means for demonstrating these proficiencies are discussed as specific requirements for each of the degrees.

REQUIREMENTS FOR THE DEGREE OF MASTER OF SCIENCE IN OCEAN ENGINEERING

All University requirements pertaining to the master's degree must be fulfilled. The following minimum requirements and information refer specifically to the degree of Master of Science in Ocean Engineering.

1. It is assumed that a student seeking this degree will have a baccalaureate in either engineering or science, with sufficient mathematics, physics, and chemistry to undertake graduate studies in engineering. To facilitate the determination of the adequacy of undergraduate preparation, the potential degree candidate should be able to demonstrate proficiency in the following subject areas:

- (a) general chemistry and physics
- (b) calculus and elementary differential equations
- (c) engineering mechanics (fluid and solid)
- (d) basic thermodynamics and heat transfer
- (e) basic electrical circuits

2. Three core courses must be included in the program of every candidate. Two core courses are specified:

- (a) MS 525. Introductory Oceanography.
- (b) OE 510 (CE 559). Engineering Oceanography.

The third core course is to be chosen from the following:

- (c) OE 530 (CE 580). Materials in the Ocean Environment.
- (d) OE 550 (EE 587). Marine Instrumentation.
- (e) OE 570 (CE 590). Engineering Design of Ocean System Payload Devices.
- (f) OE 571 (CE 591). Deep Ocean Systems Engineering and Design I.

3. Every candidate must complete two or more courses in a single specialty of the ocean engineering curriculum. Courses taken as core requirements may not be used to fulfill this obligation.

4. All candidates for this degree will complete a thesis which will account for at least 6 credits in the 30-credit program.

5. Nine of the 30 credits required for this degree may be satisfied by a selection of electives which are approved by the candidate's adviser. Electives are not restricted to engineering courses but they must form a cohesive program with a clearly defined objective. No more than 3 credits of Special Problems may be included in the program.

6. If coursework is pursued on a full-time basis it should be possible to complete the requirements for this degree in one calendar year. However, if financial aid is obtained through an assistantship, or if undergraduate deficiencies must be removed by additional coursework, a somewhat longer time will be necessary for completion of all requirements.

REQUIREMENTS FOR THE DEGREE OF DOCTOR OF PHILOSOPHY

All University requirements pertaining to this degree must be fulfilled. The following minimum requirements and information refer specifically to doctoral studies undertaken within the Ocean Engineering Program.

1. It is assumed that a student seeking this degree

will have a baccalaureate in either engineering or science, with sufficient mathematics, physics, and chemistry to undertake studies in engineering. To facilitate the determination of the adequacy of undergraduate preparation, the potential degree candidate should be able to demonstrate proficiency in the following subject areas:

- (a) general chemistry and physics
- (b) calculus and elementary differential equations
- (c) engineering mechanics (fluid and solid)
- (d) basic thermodynamics and heat transfer
- (e) basic electrical circuits

2. A core curriculum must be included in the study program of every doctoral candidate. Any or all of the core courses may have been utilized to satisfy requirements for the degree of Master of Science in Ocean Engineering; however, that degree is not a prerequisite for doctoral studies in Ocean Engineering. The core curriculum is composed of six courses:

- (a) MS 525. Introductory Oceanography.
- (b) OE 510 (CE 559). Engineering Oceanography.
- (c) OE 530 (CE 581). Materials in the Ocean Environment.
- (d) OE 550 (EE 587). Marine Instrumentation.
- (e) OE 570 (CE 590). Engineering Design of Ocean System Payload Devices.
- (f) OE 571 (CE 591). Deep Ocean Systems Engineering and Design I.

3. No specific course requirements other than the core curriculum are prescribed for the doctoral program. It is the obligation of the candidate, under the direction of his adviser, to propose a unified program of study and research which will lead to the achievement of his academic and professional objectives. The proposed program should reflect the philosophy of doctoral studies already set forth in this section; that is, a professional engineering viewpoint of ocean technology must be evident. The program must receive the unanimous approval of the candidate's Guidance Committee.

4. All candidates will be required to obtain a first-hand familiarity with the oceanic environment. Normally, this experience is obtained through responsible participation in a prolonged oceanographic cruise. Faculty of the Ocean Engineering Program provide assistance in the arrangement of appropriate cruise experience for the candidates.

5. If coursework and dissertation research are pursued on a full-time basis, it should be possible to complete the requirements for the Ph.D. degree in two calendar years following the award of a degree of Master of Science in Ocean Engineering. If financial aid is obtained through an assistantship, a somewhat longer time will be necessary for completion of all requirements. Prospective candidates will be urged to plan on the more realistic estimate of approximately three calendar years to complete the degree requirements following the award of the M.S. degree.

6. Preparation of dissertations *in absentia* will not generally be approved.

Course Offerings in Ocean Engineering

Study programs in Ocean Engineering typically consist of courses from two categories: (a) courses which are specifically oriented to ocean problems and

thus carry the Ocean Engineering designator of an OE number and (b) courses which enhance the preparation for any of the Ocean Engineering specialties but are not necessarily oriented to ocean problems. The proper selection of courses from both of these categories can ensure acquisition by the student of a broad ocean-associated knowledge combined with an acceptable level of professional competence.

The Ocean Engineering courses are listed below and grouped according to the engineering departments which offer them. Course descriptions are given under the offering department's listing.

ALL COURSES CARRY 3 CREDITS UNLESS OTHERWISE SPECIFIED

700 SERIES COURSES ARE OPEN TO GRADUATE STUDENTS ONLY. 500 AND 600 SERIES COURSES ARE OPEN TO GRADUATE STUDENTS AND UPPER-LEVEL UNDERGRADUATES WITH ADVISER'S APPROVAL AND INSTRUCTOR'S CONSENT.

Civil Engineering Department

CE 559 (OE 510). ENGINEERING OCEANOGRAPHY.

CE 581 (OE 530). MATERIALS IN THE OCEAN ENVIRONMENT.

CE 590 (OE 570). ENGINEERING DESIGN OF OCEAN SYSTEM PAYLOAD DEVICES.

CE 591 (OE 571). DEEP OCEAN SYSTEMS ENGINEERING AND DESIGN I.

CE 724 (OE 761). SUBMARINE SOIL MECHANICS AND FOUNDATION ENGINEERING.

CE 737 (OE 764). COASTAL STRUCTURES.

CE 738 (OE 765). ANALYSIS AND DESIGN OF OFFSHORE STRUCTURES.

CE 751 (OE 711). FLUID MECHANICS OF THE OCEANS.

CE 752 (OE 712). OCEAN WAVE THEORY.

CE 764 (OE 777). COASTAL ENGINEERING.

CE 781 (OE 731). MATERIALS FOR SUBMARINE STRUCTURES.

CE 783 (OE 763). STRUCTURAL MECHANICS OF DEEP SUBMERSIBLE VEHICLES.

CE 792 (OE 772). DEEP OCEAN SYSTEMS ENGINEERING AND DESIGN II.

CE 793 (OE 773). PUBLIC POLICY AND USE OF THE SEAS.

CE 796 (OE 776). OCEAN ENGINEERING FIELD LABORATORY II.

Electrical Engineering Department

EE 587 (OE 550). MARINE INSTRUMENTATION.

EE 725 (OE 721). ENERGY STORAGE AND CONVERSION.

EE 743 (OE 751). NAVIGATION.
EE764 (OE 701). UNDERWATER ACOUSTICS.

Industrial Engineering Department

IE 758 (OE 781). DESIGN OF CLOSELY-
CONFINED MANNED-OPERATIONS
STATIONS.

Mechanical and Aerospace Engineering Department

MAE 555 (OE 591, AGE 611). AQUACULTURAL
ENGINEERING SYSTEMS.

The graduate-level courses which support the objectives
of the Ocean Engineering program are listed below and
grouped according to the departments which offer them.

Chemical Engineering Department

CHE 663. SURVEY OF NUCLEAR
ENGINEERING I.

CHE 664. SURVEY OF NUCLEAR.
ENGINEERING II.

CHE 701. CHEMICAL ENGINEERING
THERMODYNAMICS I.

CHE 702. CHEMICAL ENGINEERING
THERMODYNAMICS II.

CHE 705. CHEMICAL REACTOR DESIGN.

CHE 781. NUCLEAR CHEMICAL ENGINEERING.

Civil Engineering Department

CE 522. SOIL TESTING.

CE 556. INTRODUCTION TO HYDRODYNAMICS.

CE 561. OPEN CHANNEL FLOW.

CE 720. THEORETICAL SOIL MECHANICS.

CE 794 (OE 774). FUNDAMENTALS OF NAVAL
ARCHITECTURE.

CE 795 (OE 775). OCEAN ENGINEERING FIELD
LABORATORY I.

CE 721. APPLIED SOIL MECHANICS.

CE 723. SHEAR STRENGTH OF SOILS.

CE 733. ADVANCED TOPICS IN CONCRETE.

CE 734. NUMERICAL METHODS IN
STRUCTURAL MECHANICS.

CE 735. MATRIX ANALYSIS OF STRUCTURES.

CE 741. STRUCTURAL DYNAMICS.

CE 742. EXPERIMENTAL STRESS ANALYSIS.

CE 743. ELASTICITY.

CE 744. THEORY OF PLATES AND SHELLS.

CE 745. STRUCTURAL STABILITY.

CE 757. ADVANCED FLUID MECHANICS.

UNIVERSITY OF MASSACHUSETTS

Electrical Engineering Department

EE 594. MICROWAVE ENGINEERING.

EE 601. RANDOM SIGNAL THEORY.

EE 705. ANALYSIS OF LINEAR SYSTEMS.

EE 706. ELECTROMAGNETIC FIELD THEORY.

EE 707. ADVANCED MICROWAVE
ENGINEERING.

EE 709. ADVANCED ANALYSIS.

EE 733. DIGITAL CONTROL SYSTEMS.

EE 734. OPTIMUM CONTROL SYSTEMS.

EE 735. ADAPTIVE CONTROL.

EE 745. INFORMATION THEORY.

EE 746. STATISTICAL COMMUNICATION
THEORY.

EE 747. TRANSISTOR CIRCUITS.

EE 748. NETWORK SYNTHESIS.

Industrial Engineering Department

IE 560. DESIGN OF MAN-MACHINE SYSTEMS I.

IE 571. BASIC PROBABILITY FOR ENGINEERS.

IE 572. PRINCIPLES OF ENGINEERING
STATISTICS.

IE 579. INDUSTRIAL ENGINEERING PROBLEMS.

IE 720. ADVANCED TOPICS IN OPERATIONS
RESEARCH.

IE 722. ADVANCED TOPICS IN OPERATIONS
RESEARCH.

IE 755. QUALITY CONTROL AND RELIABILITY
ENGINEERING.

IE 756. ADVANCED TOPICS IN DATA
PROCESSING.

IE 757. HUMAN FACTORS DESIGN
ENGINEERING.

IE 763. INFORMATION SCIENCE AND
TECHNOLOGY.

Mechanical and Aerospace Engineering Department

MAE 548. AEROSPACE STRUCTURES.

MAE 555. AQUACULTURAL ENGINEERING
SYSTEMS.

MAE 601. ADVANCED ENGINEERING ANALYSIS
AND DESIGN I.

MAE 602. ADVANCED ENGINEERING ANALYSIS
AND DESIGN II.

MAE 608. PHYSICAL METALLURGY PRINCIPLES.

MAE 706. ADVANCED HEAT TRANSFER II.

MAE 707. VISCOUS FLUIDS I.

MAE 709. MECHANICAL PROPERTIES OF MATERIALS.

MAE 713. ADVANCED PROPULSION SYSTEMS.

MAE 714. PRINCIPLES OF TURBOMACHINERY.

MAE 741. SHOCK AND VIBRATION.

MAE 743. STABILITY OF STRUCTURES.

MAE 746. ADVANCED VIBRATIONS.

MAE 748. THEORY OF SHELLS.

Botany Department

BOTANY 541. PHYCOLOGY.

BOTANY 741. ADVANCED PHYCOLOGY.

Geology Department

GEOL 752. GEOLOGICAL OCEANOGRAPHY.

GEOL 756. COASTAL PROCESSES.

Marine Sciences Program

MS 501. BIOLOGICAL OCEANOGRAPHY.

MS 525. INTRODUCTORY OCEANOGRAPHY.

MS 550. MICROBIAL ECOLOGY OF THE MARINE ENVIRONMENT.

Wildlife and Fisheries Biology

WILDLF 572. INTRODUCTION TO MARINE FISHERIES.

WILDLF 756. FISHERIES BIOMETRICS.

WILDLF 757. ADVANCED FISHERIES MANAGEMENT.

Zoology Department

ZOOL 571. INVERTEBRATE ZOOLOGY.

ZOOL 602. ICHTHYOLOGY.

ZOOL 635. LIMNOLOGY.

ZOOL 637. POPULATION AND COMMUNITY ECOLOGY.

Ocean Engineering courses are grouped below according to the established Program specialty areas. Course descriptions are given under the parenthesized department.

Acoustics

OE 701 (EE 764). UNDERWATER ACOUSTICS.
Prerequisite, EE 306.

Mr. Hill, Mr. Russell and/or Mr. Thomas.

Applied Physical Oceanography

OE 510 (CE 559). ENGINEERING OCEANOGRAPHY.

Prerequisite, CE 257 or permission of instructor.

Mr. Colonell, Mr. Mangarella.

OE 711 (CE 751). FLUID MECHANICS OF THE OCEANS.

Prerequisites, OE 510 and CE 556.

Mr. Colonell, Mr. Mangarella.

OE 712 (CE 752). OCEAN WAVE THEORY.

Prerequisites, OE 510 and CE 556.

Mr. Colonell.

OE 721 (EE 725). ENERGY STORAGE AND CONVERSION.

Mr. Monopoli and/or Mr. Sheekels.

Marine Corrosion and Materials Engineering

OE 530 (CE 580). MATERIALS IN THE OCEAN ENVIRONMENT.

Prerequisite, Introductory Oceanography (MS 525).

Mr. Lindsey or Mr. Harris.

OE 731 (CE 781). MATERIALS FOR SUBMARINE STRUCTURES.

Prerequisite, OE 530.

Mr. Harris.

Navigation, Control, and Information Processing

OE 550 (EE 587). MARINE INSTRUMENTATION.
Prerequisite, MS 525.

Mr. Hutchinson.

OE 751 (EE 743). NAVIGATION.

Mr. Hutchinson.

OE 752 (EE 736). DYNAMICS AND CONTROL OF MARINE VEHICLES.

Mr. Hutchinson and/or Mr. Monopoli.

Ocean Structures and Marine Foundations

OE 761 (CE 724). SUBMARINE SOIL MECHANICS AND ENGINEERING.

Prerequisite, CE 220.

Mr. Bemben.

OE 763 (CE 783). STRUCTURAL MECHANICS OF DEEP SUBMERSIBLE VEHICLES.

Prerequisites, CE 141 (MAE 246) and CE 240.

Mr. Dzialo, Mr. Nash.

OE 764 (CE 737). COASTAL STRUCTURES.

Prerequisites, CE 232 and 333.

Mr. Osgood.

OE 765 (CE 738). ANALYSIS AND DESIGN OF OFFSHORE STRUCTURES.

Prerequisites, OE 510, CE 534, and CE 540.

Mr. Miller.

Ocean Systems Design and Engineering

OE 570 (CE 590). ENGINEERING DESIGN OF OCEAN SYSTEM PAYLOAD DEVICES.

Prerequisite, Introductory Oceanography (MS 525).

Mr. Adams.

OE 571 (CE 591). DEEP OCEAN SYSTEMS ENGINEERING AND DESIGN I.

Three class hours, one 3-hour laboratory period.

Credit, 4. Mr. Heronemus.

OE 772 (CE 792). DEEP OCEAN SYSTEMS ENGINEERING DESIGN II.

Three class hours, one 3-hour laboratory period.

Prerequisite, OE 571. Credit, 4. Mr. Heronemus.

OE 773 (CE 793). PUBLIC POLICY AND THE USE OF THE SEAS.

One class hour.

Credit, 1. Mr. Heronemus.

OE 774 (CE 794). FUNDAMENTALS OF NAVAL ARCHITECTURE.

Three class hours, one 3-hour laboratory period.

Credit, 4. Mr. Adams, Mr. Heronemus.

OE 775 (CE 795). DEEP OCEAN SYSTEMS ENGINEERING FIELD LABORATORY I.

Prerequisite, completion of OE core curriculum.

(Summer only.)

OE 776 (CE 796). OCEAN ENGINEERING
FIELD LABORATORY II.

Prerequisite, OE 775. (Summer only.)

OE 777 (CE 764). COASTAL ENGINEERING.

Prerequisite, CE 559 or permission of instructor.

Mr. Colonell.

OE 781 (IE 758). DESIGN OF CLOSELY-
CONFINED MANNED-OPERATIONS
STATIONS.

Three class hours, one 2-hour laboratory period.

Prerequisite, IE 757 or permission of instructor.

Credit, 4. OE Staff.

Systems for Aquacultural Engineering

OE 591 (MAE 555) (FAE 555).

AQUACULTURAL ENGINEERING SYSTEMS.

Mr. Zahradnik.

Classics

GRADUATE FACULTY

GILBERT W. LAWALL, *Head of the Department and Professor*, B.A., Oberlin College, 1957; Ph.D., Yale, 1961.

VINCENT J. CLEARY, *Director of Graduate Studies in Latin and Associate Professor*, B.S., St. Joseph's College, 1954; Villanova University, 1959; Ph.D., University of Pennsylvania, 1967.

ROBERT R. DYER, *Director of Graduate Studies in Classical Humanities and Professor*, B.A., Auckland University College, 1954; M.A., University of New Zealand, 1955.

ROBERT J. GOAR, *Assistant Professor*, B.A., Harvard College, 1954; M.A., Harvard University, 1958; Ph.D., 1968.

EDWARD PHINNEY, JR., *Associate Professor*, B.A., University of Oregon, 1957; M.A., 1959; Ph.D., University of California at Berkeley, 1963.

ELIZABETH LYDING WILL, *Assistant Professor*, B.A., Miami University, 1944; M.A., Bryn Mawr College, 1945; Ph.D., 1949.

Although the University does not offer advanced degrees specifically in classics, graduate-level courses in classics, Greek, and Latin are available as electives for students enrolled in other programs and are especially recommended as background for students in comparative literature, English, history, and modern foreign languages and literatures. Intensive elementary courses in the Greek and Latin languages are open to graduate students on a no-credit basis (consult the *Undergraduate Course and Faculty Directory*).

The degree of Master of Arts in Teaching may be earned in Latin and/or classical humanities by arranging carefully-coordinated programs of study involving work in education as well as in the subject-matter field. Normally 12 credits are taken in education (including courses in educational psychology, and methods courses in the Department of Classics) and a

minimum of 12 credits in classics. Thirty-six credits are required for the degree; students may complete the program in a year and a summer, or they may choose to spend two years completing it. The program in Latin is open both to those desiring certification to teach Latin in secondary schools and to present teachers of Latin who wish to deepen their knowledge of ancient languages, literatures, and civilizations and to explore new methods and materials for the teaching of Latin and the classics. The program in classical humanities is designed primarily for those who are already certified to teach Latin and wish to gain a wider knowledge of literature, civilization, and the classical tradition in order to prepare themselves for teaching in humanities programs in high schools or junior colleges. Both programs are extremely flexible, and students may combine the two programs into one. Relevant courses may be taken in art, history, philosophy, English, and in comparative literature. Students may supplement their work at the University with approved courses at the neighboring colleges (Amherst, Mount Holyoke, and Smith) under the Five-College Cooperation Program. All those preparing for teaching careers in Latin or in the classics are strongly urged to equip themselves with a minor in some other teaching field such as English, French, Spanish, history or mathematics. Generally, at least 18 hours of undergraduate and graduate work should be taken in the minor. It is strongly recommended that applicants complete courses in educational psychology and foundations or philosophy of education before beginning the program. Supervised practice teaching is done in Latin or classics courses at the University and in area high schools. Special innovative projects and internships can be arranged, especially for those students who choose to spend two years in the program.

The following Latin teachers in the state will serve as consultants to the Master of Arts in Teaching program in Latin and classical humanities for the 1972/1973 academic year: Mr. Charles Bradshaw (Ludlow High School), Mrs. Marie Frisardi (Boston Latin School), Mr. William Gleason (South Hadley High School), Mr. Arthur Leavitt (Marblehead High School), Mr. Francis Smith (Wayland High School), Mrs. Lorraine Teller (Northampton-Williston Academy). These teachers will be available to meet with our M.A.T. students periodically throughout the year, and they will help to arrange innovative practice-teaching experiences in Latin and the humanities in their own and other high schools in the state.

CLASSICS

ALL COURSES CARRY 3 CREDITS UNLESS
OTHERWISE SPECIFIED

CLASSICS 500. THE HUMANITIES.

The history and scope of the classical humanities as an educational discipline from their original function in the rhetorical training of orators, lawyers and administrators, as an education in moral and social values and in psychological manipulation, to the goals of the modern liberal arts college. Assessment made of the success or failure of humanist education in its various phases, with attention to the careers of those trained in this tradition. Three class hours, plus tutorial session.

CLASSICS 505. THE MATERIAL WORLD OF THE ROMANS.

The Romans as people on the basis of the archaeological evidence about their daily lives (their houses, pottery, coins, glass, textiles). Special attention to the finds from Pompeii.

Three class hours, plus tutorial session.

CLASSICS 506. THE ANCIENT CITY.

The city and the rise of city-planning in antiquity in the Near East, Greece, and Italy; stress on sociological and economic aspects. Special attention to the city of Rome and its urbanization in the Roman Empire.

Three class hours, plus tutorial session.

CLASSICS 525. MYTHOLOGY IN THE ANCIENT WORLD.

The structural affinities between Greek myth and earlier or contemporary myth from the ancient Near East; the influence of these traditional modes of mythic thought on the religions, society, and literature of Western civilization.

Three class hours, plus tutorial session.

CLASSICS 526. MYTHOLOGY IN ANCIENT ART.

The legendary cycles of Greek mythology and their Near-Eastern sources; the major deities and demons of Sumerian, Babylonian, Egyptian, Hittite, and Greek religions.

Three class hours, plus tutorial session.

CLASSICS 561. GREEK LITERATURE IN TRANSLATION.

Homer, lyric poetry, the major dramatists, selected dialogues of Plato, Herodotus, Thucydides, and their relations to the classical tradition.

Three class hours, plus tutorial session.

CLASSICS 562. LATIN LITERATURE IN TRANSLATION.

The development of Latin literature from Greek models; the emergence of uniquely Roman forms of comedy, tragedy, epic, lyric, pastoral, satire, history, biography, and novel; their influence on later literature.

Three class hours, plus tutorial session.

CLASSICS 565. GREEK DRAMA IN TRANSLATION.

Thematic analysis of selected Greek tragedies and comedies; typical characterization, cultural, political, and social values as expressed in the plays.

Three class hours, plus tutorial session.

CLASSICS 567. THE ANCIENT NOVEL.

The ancient "short story" and the collections of interbraided stories that formed the original prose-fiction novels; the authors' artistic goals and limitations; the nature and needs of the ancient fiction-reading audience; competition with more traditional literary forms; informing contributions to the modern genre of Western novel.

Three class hours, plus tutorial session.

CLASSICS 575. THEMES IN CLASSICAL LITERATURE.

A major theme in classical literature, such as the hero or anti-hero, women, the individual and society, urban problems, the rise of science, or religion.

Three class hours, plus tutorial session.

CLASSICS 585. THE GREEK MIND.

The development of thought in the Greek world from Homer to Aristotle, tracing the evolution of mental concepts and ways of thinking about man and the world around him.

Three class hours, plus tutorial session.

CLASSICS 595. INTERPRETING ANCIENT MYTH.

What some thinkers have said about ancient myth for

over 3,000 years; possible reasons for their misreading ancient myth; their prejudices and presuppositions; their shaping of popular modern views of ancient myth; their inability to reach a common definition of myth; future trends of myth interpretation.

Prerequisite, Classic 525 or 526 or permission of instructor.

Three class hours, plus tutorial session.

(The following courses require a reading knowledge of Greek and/or Latin.)

CLASSICS 608. THE TEACHING OF CLASSICAL HUMANITIES IN SECONDARY SCHOOLS.

Guidance in preparing enrichment material in Latin language classes and in designing and teaching courses dealing with classical life and institutions, drama, art, mythology, and literature in translation on the secondary level.

CLASSICS 700. SPECIAL PROBLEMS.

Directed study of some problem in classical civilization.

Credit, 1-6.

CLASSICS 701. THE ROMAN CITY.

The topography, monuments, and daily life of selected Roman cities with emphasis on Rome itself. Sociological, economic, and environmental factors in ancient city planning. May involve travel and study in Italy. By arrangement.

Credit, 3-6.

GREEK

GREEK 700. SPECIAL PROBLEMS.

Directed study of some problem in Greek literature.

Credit, 1-6.

LATIN

LATIN 500. ADVANCED GRAMMAR AND STYLE.

Structure of the language; evolution of grammatical and linguistic concepts and terminology used to describe it. Analysis of the style of representative Latin prose authors and exercises in composition in imitation of these authors.

LATIN 505. ORAL INTERPRETATION OF LATIN LITERATURE.

Practice in the expressive reading of Latin texts.

One class hour.

*Credit, 1
May be repeated up to 3 credits.*

LATIN 607. TEACHING THE LATIN LANGUAGE.

Methods and materials for teaching the Latin language in secondary schools. May be coordinated with practice teaching experiences.

Credit, 3-6.

LATIN 608. TEACHING LATIN LITERATURE.

Methods and materials for teaching Latin literature in secondary schools. May be coordinated with practice teaching experiences.

Credit, 3-6.

LATIN 625. THE LATIN POLITICAL TRACT.

Selections from Sallust and Caesar accompanied by an historical and literary analysis of their works.

LATIN 626. LATIN DIDACTIC EPIC.

Selections from Lucretius, Vergil's *Georgics*, and Ovid's *Ars Amatoria*.

LATIN 627. LATIN HISTORY AND BIOGRAPHY.

Selections from Livy, Tacitus, and Suetonius.

LATIN 628. LATIN DRAMA.

Selected plays of Plautus, Terence, and Seneca.

LATIN 629. LATIN ESSAYS AND LETTERS.

The Roman mind as revealed in the philosophical works of Cicero and the moral epistles of Seneca; Roman pri-

vate life and personal concerns as revealed in the letters of Cicero and Pliny.

LATIN 630. LATIN ELEGIAC POETRY.

Selections from Catullus, Tibullus, Propertius, and Ovid.

LATIN 631. CICERO'S ORATIONS.

The major orations of Cicero interpreted against their social and political background and analyzed according to ancient rhetorical theories.

LATIN 632. LYRIC POETRY.

Selected lyrics of Catullus and Horace.

LATIN 633. VERGIL'S AENEID.

The entire poem with attention to traditional and contemporary critical perspectives and evaluations.

LATIN 700. SPECIAL PROBLEMS.

Directed study of some problem in Latin literature.

LATIN 701. EXPLORING LATIN LITERATURE.

Exploratory readings in a variety of Latin authors.

Credit, 2-6.

LATIN 790. SEMINAR.

Intensive, advanced study of some aspect of Latin literature.

Credit, 3-6.

Credit, 3-6.

LATIN 800. MASTER'S THESIS.

Research and writing of a master's thesis.

Maximum credit, 9.

Comparative Literature

GRADUATE FACULTY

WARREN D. ANDERSON, *Chairman of the Department of Comparative Literature and Professor, B.A., Haverford, 1942; B.A. (Oxon.), 1949; M.A., Harvard, 1947; Ph.D., 1954.*

ERIC M. BEEKMAN, *Associate Professor of Germanic Languages and Literature and Associate Professor of Comparative Literature.*

DAVID R. LENSON, *Assistant Professor of Comparative Literature, B.A., Princeton, 1967; M.A., 1970; Ph.D., 1971.*

DON E. LEVINE, *Assistant Professor, B.S., Columbia, 1964; M.A., Princeton, 1967; Ph.D., 1972.*

LUCIEN M. MILLER, *Assistant Professor, B.A., California at Berkeley, 1961; M.A., 1963; Ph.D., 1970.*

C. WILLIAM MOEBIUS, *Assistant Professor, B.A., Lawrence (Wis.), 1963; Ph.D., S.U.N.Y. at Buffalo, 1969.*

FREDERICK WILL, *Professor, B.A., Indiana, 1949; Ph.D., Yale, 1954.*

SUPPORTING FACULTY

THOMAS CASSIRER, *Professor of French.*

SARAH N. LAWALL, *Associate Professor of French.*

PAUL A. MANKIN, *Associate Professor of French.*

WILLIAM E. NAFF, *Associate Professor of Japanese.*

ALEX R. PAGE, *Professor of English.*

EVA SCHIFFER, *Associate Professor of German.*

The Department of Comparative Literature offers graduate work leading to the degrees of Master of Arts and Doctor of Philosophy. Facilities and staff

are available for specialized work in classical tradition studies and in medieval, Renaissance, Enlightenment, Romantic, modern, and contemporary European literature. Courses or seminars dealing with genres, themes, or movements are regularly offered as well. It is also possible to specialize in the study of Dutch literature or of classical and modern Chinese and Japanese literature. Graduate courses in Comparative Literature are open to all qualified graduate students and may, with prior approval of the other department or program concerned, be taken to meet a foreign language requirement.

PREREQUISITES FOR ADMISSION TO THE M.A. OR PH.D. PROGRAM

(beyond the usual requirements of the Graduate School)

Undergraduate Degree: Applicants must possess a bachelor's degree or a recognized foreign equivalent, either with a major in a language-literature field or awarded upon completion of substantial literary studies.

Languages: All applicants are required to have at least two major languages besides English; one of these must be either French or German. Applicants who intend to work toward the Ph.D. should have completed, with a grade of B or better, at least three years' undergraduate study of one of these languages and two years' study of the other. Applicants who are planning a course of study leading to the terminal M.A. should have at least three years' undergraduate study of one of these languages and one year of the other.

Intending doctoral students who do not offer for admission at least three years' study of Greek or Latin past high school level will be required to pursue further study of one of these languages.

Students whose native language is not English must demonstrate reasonable fluency in English by examination or enroll for remedial course work.

Grade Point Average: The applicant should have a grade point average equivalent to at least 3.0 out of a possible 4.0.

Graduate Record Examination: This examination is required of all applicants, without exception.

Written Work: Applicants are required to submit with their applications an example (unique copies should not be sent) of written work which may be taken as fairly demonstrating their critical abilities in dealing with literary material. It is preferred, though not absolutely required, that the applicant should have read this material in the original language of composition, and that it be taken from an ancient or modern foreign literature.

THE DOCTOR OF PHILOSOPHY DEGREE

Qualification: Successful completion of the qualifying procedure enables the student to proceed with preparations for the preliminary comprehensive examination, beginning with the formation of a guidance committee. The qualifying procedure involves competence in foreign languages and a reasonable degree of professional maturity, as shown in the successful completion of basic graduate courses within the department.

Languages: Students are required to demonstrate competence in two foreign languages, one of which

may be Latin or Greek. This requirement may be met by a satisfactory performance in a two-hour written examination; other options are also available.

Program of Study: The balance among the main constituent elements of a candidate's course of study will necessarily vary with individual circumstances. The following kinds of competence, however, are taken to characterize the holder of a Ph.D. in comparative literature: a knowledge of one language and its literature sufficient to warrant the respect of specialists; a reading knowledge of three major European or Oriental languages (ancient or modern) in addition to English; a wide command of the literature of one main historical period; ability to make serviceable use of at least three literatures, one of which may be English; a reading competence in a classical language; and training in research method, literary translation, and problems of criticism.

Requirements: Work in the major literature requires historical coverage from the earliest literary forms of the language to the present, with emphasis either on a genre or on a major period, and a thorough reading-knowledge of the language. Work in the second and third literatures requires coverage of the period or genre related to the field of emphasis in the major literature. Reading knowledge of the languages involved should be very good in the case of the second literature and good in the case of the third. Finally, work in Comparative Literature courses and seminars will be determined according to the candidate's needs in acquiring the ability to deal with the broad demands of the discipline and the more limited ones of his special field.

The Preliminary Comprehensive Examination: Successful completion of this examination allows the candidate to proceed to the dissertation. In its standard form, the examination consists of the following two parts: a written portion, lasting ten hours, which covers in depth one literary period or genre that the candidate has studied in three literatures, and also the general history of the major literature; an oral portion, following the written, which will last not less than two hours. The option of a 2-hour oral examination with previous satisfactory completion of a number of assigned papers is also available, conditional upon the approval of the candidate's guidance committee.

The Dissertation: This may be concerned with any subject in literary history or with the critical comparison of texts, carried on within a literary rather than a philosophical frame of reference. The candidate's guidance committee may approve the option of a translation dissertation, provided that the project is judged to admit of the inclusion of an extensive critical introduction, undertaken at a level of analysis appropriate to a doctoral dissertation.

THE MASTER OF ARTS DEGREE

Two types of M.A. degrees are offered in Comparative Literature. Students who do not plan to proceed to the Ph.D. will normally choose the M.A. with thesis; the M.A. without thesis should be elected as a degree plan by students planning doctoral study.

Program of Study: A minimum of 30 credit hours will be required in all cases. This total is to be distributed as follows: 12 graduate (500-level or higher) credits in the major literature, 6 upper-division (200-

level or higher) or graduate credits in a second literature studied in the original language of composition, and 6 graduate credits in Comparative Literature courses. One of these courses must be Comparative Literature 701 (Bibliography and Methods of Literary Research). Students who elect the M.A. without thesis must take at least 9 credits in a second literature and also in Comparative Literature.

Examinations: All candidates for the M.A. are required to take a written examination lasting four hours and an oral examination lasting at least one hour.

Thesis: The M.A. thesis is intended to demonstrate ability to formulate and resolve a specific literary problem, relatively limited in scope. A thesis consisting of a translation preceded by a substantial critical introduction will be considered an acceptable alternative to the regular thesis form, subject to conditions similar to those specified above in connection with translation dissertations.

ALL COURSES CARRY 3 CREDITS UNLESS OTHERWISE SPECIFIED

COURSES OPEN TO GRADUATE STUDENTS ONLY

700. SPECIAL PROBLEMS.

Directed study of some problem in comparative literature. May be repeated for credit. *Credit, 2-6.*

701. BIBLIOGRAPHY AND METHODS OF LITERARY RESEARCH.

Introduction to the bibliography and methodology of comparative studies in literature.

Miss Schiffer, Mr. Levine.

702. LITERARY CRITICISM I: CLASSIC TO NEOCLASSIC.

Problems in critical theory prior to the modern period. Not necessarily chronological or limited to Occidental critics.

703. LITERARY CRITICISM II: INTRODUCTION TO THE HISTORY OF CONSCIOUSNESS.

Modern crises of consciousness, ethics, and form, as manifested in seminal works of avant-garde criticism and fiction. *Mr. Levine.*

704. CONTEMPORARY THEORIES OF LITERATURE.

Intensive study of theories of literature which have importance for contemporary criticism and scholarship.

Mrs. Lawall, Mr. Will.

705. THEORY AND PRACTICE OF TRANSLATION.

The history of translation theory. Intensive practical experience in translating poetry and prose.

Mr. Anderson, Mr. Moebius, Mr. Will.

890. SEMINAR.

Intensive, advanced study of a topic in comparative literature. *Credit, 3-6.*

900. DOCTORAL DISSERTATION.

COURSES OPEN TO BOTH GRADUATE AND UNDERGRADUATE STUDENTS

621. RENAISSANCE PERSPECTIVES.

The tradition of the Middle Ages, the heritage of the Renaissance—the rhetoric of writing and the arts of reading and interpretation as handed down to the Renaissance. *Mr. Levine.*

622. THE SHAPE OF THE RENAISSANCE.

Diversity and changes of literary style in the 15th and

16th centuries. Emphasis on cultural continuity. An examination of critical method. Mr. Levine.

631. THE ENLIGHTENMENT.
Characteristic ideas, themes, and attitudes in 18th-century European literature. Focus on major representatives of the Age of Reason. Mr. Page, Mr. Will.

641. ROMANTICISM.
The Romantic movement in Western literature as exemplified by its principal figures from the age of Rousseau to 1850.

642. FROM IDEALISM TO REALISM.
Main currents in the post-Romantic literature of the nineteenth century.

647. LITERATURE AND MUSIC.
Relations between literature and music from Plato to Samuel Beckett. Emphasis on the aesthetics of Schopenhauer and the Wagnerian synthesis. Mr. Moebius.

651. SYMBOLISM.
The development of symbolism in English, French, and German poetry of the 19th and 20th centuries. Mr. Lenson, Mr. Mankin.

652. MODERN DRAMA.
Currents in Western drama since Ibsen: naturalism, symbolism, neo-Romanticism, expressionism, folk drama and fantasy, epic realism, and the "grotesque" and "absurd" theatre are possible topics. Mr. Mankin, Mr. Moebius.

661. THE CONTEMPORARY EUROPEAN NOVEL.
Ideological commitments and innovations in English, French, and German novels of the 20th century.

671. EUROPEAN EPIC POETRY.
Literary analysis of major classical and Renaissance epics. Emphasis on their intrinsic qualities as works of art. Specific epic techniques and the epic tradition. Mr. Anderson.

675. ANGLO-GERMAN LITERARY RELATIONSHIPS.
Subjects and problems common to English and German literature since the middle of the 18th century. Mr. Page.

676. THEORIES OF COMPARATIVE LITERATURE.
Major theories concerning the nature and proper province of comparative literature. Emphasis on their significance for graduate study. Mr. Will.

Computer and Information Science

GRADUATE FACULTY

MICHAEL A. ARBIB, *Chairman of the Program, Professor of Computer and Information Science, and Associate Director of the University Computing Center, B.S., University of Sydney, 1961; Ph.D., Massachusetts Institute of Technology, 1963.*

G. ERNEST ANDERSON, *Associate Professor of Education.*

ROBERT R. ARCHER, *Professor of Civil Engineering.*

LEONARD S. BOBROW, *Assistant Professor of Electrical Engineering.*

RICHARD H. ECKHOUSE, JR., *Assistant Professor of Computer and Information Science, B.E.E., Cornell*

University, 1962; M.S., University of Illinois, 1963; Ph.D., SUNY at Buffalo, 1971.

ROGER W. EHRLICH, *Assistant Professor of Electrical Engineering.*

CAXTON C. FOSTER, *Professor of Computer and Information Science, B.S., Massachusetts Institute of Technology, 1950; M.S., University of Michigan, 1957; Ph.D., 1965.*

ROBERT M. GLORIOSO, *Associate Professor of Electrical Engineering.*

WILLIAM L. KILMER, *Professor of Computer and Information Science, B.S., Pennsylvania State, 1954; M.S., 1955; Ph.D., University of Michigan, 1958.*

HENRY LEDGARD, *Associate Professor of Computer and Information Science, B.S., Tufts University, 1964; M.S., Massachusetts Institute of Technology, 1966; Ph.D., 1969.*

JOHN A. N. LEE, *Professor of Computer and Information Science, B.S., University of Nottingham, 1955; Ph.D., University of Massachusetts, 1967.*

ERNEST G. MANES, *Assistant Professor of Mathematics.*

HOWARD A. PEELLE, *Assistant Professor of Education.*

EDWARD M. RISEMAN, *Assistant Professor of Computer and Information Science, B.S., Clarkson College of Technology, 1964; M.S., Cornell University, 1966; Ph.D., 1969.*

KENAN SAHIN, *Associate Professor of Management.*

SUE N. STIDHAM, *Assistant Professor of Computer and Information Science, B.A., Smith College, 1959; Ph.D., University of Massachusetts, 1964.*

FRED D. STOCKTON, *Associate Professor of Civil Engineering.*

ROBERT W. TAYLOR, *Assistant Professor of Computer and Information Science, B.S., Yale University, 1966; M.S., University of Michigan, 1968; Ph.D., 1971.*

RICHARD L. TENNEY, *Assistant Professor of Computer and Information Science, B.A., University of California at Los Angeles, 1965; M.S., Cornell University, 1969; Ph.D., 1972.*

CONRAD A. WOGGIN, *Professor of Computer and Information Science and Director of the University Computing Center, B.Eng., Yale, 1949; M. Eng., 1951; Eng.D., 1955.*

The program in Computer and Information Science (COINS) offers the M.S. and Ph.D. degree in the three focal areas of computers, theory of computation, and cybernetics. Comprehensive course offerings are available, and active research is ongoing, in each of these areas, as well as in inter-area fields. Active collaboration is maintained with colleagues in such diverse schools and departments as Art, Business, Education, Electrical Engineering, Linguistics, Mathematics, Psychology, and Zoology. Students are encouraged to take advantage of these interdepartmental links to enrich their university experience.

Students in the graduate program should be aware of the ongoing seminar series, which meets on Thursday afternoons. All students are strongly recommended to attend as part of rounding out their graduate education. In addition, most advanced stu-

dents will wish to take part in the research seminars (700 A, B, C) in their own area of concentration.

To be admitted to full graduate status in this field, candidates must be holders of B.S. or B.A. degrees, with good academic records and recommendations, and have either a major in Computer Science or exhibit a good knowledge of computer programming and college mathematics. Students are expected to have mastered the equivalent of COINS 122 and 133 and Math 167: Introduction to Linear Algebra (co-requisite, second semester of calculus). Exceptions will be exceptional.

Students who have already studied computer science will note that at most 6 credits may be transferred from other institutions, and these must be of a grade B or better. It is the policy of the department to grant such transfer credit sparingly, since we believe that our program is sufficiently rich for most students to be able to take a full 24 units of course credit to their advantage.

THE MASTER OF SCIENCE DEGREE PROGRAM

The following are the requirements for the M.S. degree in Computer and Information Science:

- (i) Each student shall take (or receive advanced standing in) the core courses 501, 502, 503, and 504.
- (ii) Each student shall take two COINS 700 series courses other than 701.
- (iii) Each student shall take 6 units of COINS 701, Project. The project must be completed in one semester, with a grade of B or better. Students are required to plan their project in the semester preceding that in which they register for 701. A written proposal must be approved by a faculty member as first reader, and submitted to the Chairman by the preregistration day preceding the semester of registration. The faculty then meets to approve the proposals and assign second readers.
- (iv) Each student shall take additional graduate courses, chosen with the approval of the adviser, to satisfy the 30-credit requirement for the M.S. degree. Each student must obtain a B grade average or better in the 24 units other than the project.
- (v) Students entering with deficiencies in the equivalent of COINS 122, 133, or Math 167 are required to remove these deficiencies by the end of their first semester. The credits so obtained do not count toward the 30 credits for the M.S. degree.

THE PH.D. QUALIFYING EXAM

A qualifying examination is offered in March and October of every year. Students enrolled as M.S. candidates who wish to proceed to the Ph.D. program are advised to first take the examination in the semester preceding enrollment in COINS 701; they normally are expected to pass the exam before being admitted to the second year of their Ph.D. candidacy.

There are three COINS *areas* (computers, theory of computation, and cybernetics) and four *core courses* (501; 502; 503; 504). The content of the four core courses, as laid down in the official syllabi, serve as the conceptual base for the exam, which tests the student's ability to *relate* and *apply* the fundamental concepts of the core courses. However,

the grading of the exam is *not* based on detailed knowledge of the core so much as on the ability to think in a creative and intelligent manner.

The exam is in two parts:

- (i) A written open-book examination. The student has from 9:00 a.m. to 5:00 p.m. on a given day to complete the written exam, and may work in a place of his own choosing. The exam consists of a total of nine questions, three in each of the three areas. [Note: A question in any *area* may make use of concepts from any of the four core *courses*.] Students answer at least two questions in their major area of interest, and one in each of the other two areas.
- (ii) After correction, the written exam is returned to the student for review. An oral interview is then required.

The student is graded as either (1) Pass; (2) Fail with remedial advice for taking the exam again, or (3) Unconditional Fail. This grade is based not only on performance in the exam, but also on course grades and other faculty input.

Students who do not pass the exam the first time are given at most one further opportunity to do so, subject to the timing conditions outlined in the first paragraph.

Only students with at least a B average in the four courses (or equivalent standing) and a Grade Point Average above 3.0 are allowed to take the exam. Students are invited to discuss with the faculty their likelihood of passing before deciding to stand for the qualifying examination.

THE DOCTOR OF PHILOSOPHY DEGREE

To be confirmed in their candidacy for the Ph.D. Degree, students must pass the Ph.D. qualifying exam, as described above. In addition to course work appropriate to the M.S. degree, Ph.D. students are required to take some six 700-level courses from both within and without the department to lay a firm basis for thesis research. There is no formal language requirement for the degree. Students are discouraged from taking more than two or three years beyond the M.S. to complete their Ph.D. degree. M.S. candidates intending to proceed to the Ph.D. should choose their 701 projects with this time restriction in mind. Other conditions for the Ph.D. are as listed under general University requirements.

ALL COURSES CARRY 3 CREDITS UNLESS OTHERWISE SPECIFIED

COURSES OPEN TO GRADUATE STUDENTS ONLY

700. SPECIAL PROBLEMS.

Topic by arrangement each semester. Recent advances and current problems in a specialized field of computer science.

Prerequisite, permission of instructor. *Credit, variable.*

701. ADVANCED TOPICS IN COMPUTER SCIENCE.

A project-type course for second-year graduates which integrates and expands the student's knowledge of the field. Moderately large projects of implementation and/or design of computers, languages, operating systems, cybernetic simulation, theoretical integration, etc.

Prerequisite, permission of instructor. *Credit, 6.*

741. COMPUTABILITY AND COMPLEXITY.

The idea of recursion; partial recursive functions and

their algebraic and machine characterizations; primitive recursive functions and hierarchies of partial recursive functions; complexity of computation by both axiomatic and machine-oriented criteria; speed-up and gap theorems. Prerequisites, COINS 501 and 504, or permission of instructor.

743. TOPICS IN THEORY OF COMPUTATION. Algebraic automata theory; advanced topics in language theory; theory of problem-solving in hierarchically-structured systems; theory of machines which compute and construct; related advances in theory of theorem-proving. Prerequisite, COINS 540.

762. SEMANTIC DEFINITION. Theoretical basis and applications, with a wide variety of examples, for semantics of computer languages, with emphasis on PL/1 and the Vienna Definition Language. Prerequisites, COINS 504 and 511.

777. OPERATING SYSTEMS. Systems analysis, feasibility studies, and applicable techniques of operating systems. Input/output file control systems; remote terminal devices, management information systems and other on-line applications, case studies, design and use of extended machine language function facilities for systems programming. Prerequisites, COINS 502, 523, and 535.

782. COMPUTATIONAL CYBERNETICS. An advanced sequel to 503. A computer simulation model of the core of the vertebrate nervous system, the reticular formation; the Didday-Arbib model of the frog's optic tectum; Grossberg's learning equations; a comparison of several models of the cerebellum; Marr's mathematical models of archicortex and neocortex; a detailed computer simulation model of part of the mammalian hippocampus; the Cowan-Wilson model of statistical neuronal processing in neocortex; advanced considerations for an action-oriented model of human vision. Prerequisites, COINS 501, 503, and 504.

783. ARTIFICIAL INTELLIGENCE. Game-playing by machines; the General Problem Solver and related programs; mathematical theory of heuristic search; automatic theorem-proving; question answering systems; natural language processing; an introduction to robotics. Prerequisites, programming ability, COINS 501 and 503.

784. ADVANCED PATTERN RECOGNITION. Techniques of advanced pattern recognition; optical character recognition (typed and handwritten); measurement selection; feature extraction and contextual cueing; automata and grammars for two-dimensional patterns. Prerequisites, COINS 503 and 504.

787. DATA STRUCTURES. Methods and systems for information retrieval and correlation presented so as to relate the defining of purposes and requirements with the specifying of operations performed by machine and by people. Particular principles and mathematical formulation. Prerequisites, COINS 501 and 502.

790. SEMINAR ON COMPUTER AND INFORMATION SCIENCE. Conferences, reports, and lectures on topics not currently covered in regular courses. Prerequisite, permission of instructor. *Credit, 1-6.*

900. DOCTORAL DISSERTATION. *Credit, 30.*

COURSES NOT FOR MAJOR CREDIT

409. TOOLS OF RESEARCH.

COURSES OPEN TO GRADUATE AND UNDERGRADUATE STUDENTS

501. CORE COURSE A.

Integrates application and theory in presenting such fundamental concepts of Computer and Information Science as successors and precursors; loops and iteration; state diagrams and basic notions of automata, switching theory, and regular sets; trees, formal grammars; syntax and semantics; tree automata and pushdown automata; proving properties of programs. Prerequisite, Math 200.

502. FUNDAMENTALS OF COMPUTERS.

Provides core concepts of computers, including name-address value; data structures and accessing strategies; stored-program computers; interprocessor relations, and cost-performance trade-off. Lab involves hands-on experience with programs, loaders, assemblers, and operating systems. Prerequisites, COINS 122 and 133.

503. FUNDAMENTALS OF CYBERNETICS.

Integrates brain analysis and robot design to convey a basic understanding of systems and neural networks, modelling, feedback; scene analysis and pattern recognition in brains and machines; parameter adjustment and adaptation; heuristic search; and planning of complex behavior in the brains of animals and the control computers of robots.

504. CORE COURSE B.

Builds on Core Course A in integrating theory and application to present such fundamental concepts as discrete probability theory applied to pattern recognition and information theory; Turing machines, Godel's theorem and self-reproducing automata; semigroups applied to coding and automata theory; rings, fields, linear machines and codes. Prerequisite, COINS 501.

510. TRANSLATOR DESIGN.

The technique of language definition, translation with particular reference to symbolic assemblers and algebraic compilers. Prerequisites, COINS 501 and (502 or 523); 511 is desirable, but not required.

511. SYNTACTIC ANALYSIS.

Introduction to the concepts and techniques of syntactical analysis with respect to context-free grammars, the cognitive processes involved in the analysis and generative algorithms of computer translators. Special consideration of precedence grammars and semantic implications of grammars. Prerequisites, COINS 501 and (502 or 523).

523. MACHINE AND ASSEMBLY LANGUAGE.

A description with substantial examples and exercises of the structure of a large-scale computer; its operating systems and language leading to studies of assembly and macrolanguage capabilities. Lab required. Prerequisites, COINS 122 and 133.

524. ADVANCED PROGRAMMING.

Use of list-processing and associative type computers. Design of interpreters for these machines and assembly language programming. Design of higher-level languages for them. Prerequisites, COINS 502 or 523.

525. SIMULATION LANGUAGES.

Discussion and use of discrete and continuous simulation languages. SIMSCRIPT 1.5, GASP, GPSS, CPM, CSMP, DYNAMO, CSSL. Prerequisites, COINS 550 or simulation experience.

533. MINICOMPUTERS.

The use and programming of a small scale digital computer for data-gathering, analysis and on-line control of experiments. Interfacing computers and experiments. Logical design of I/O.
Prerequisite, COINS 523.

535. COMPUTER ARCHITECTURE.

The various design concepts of computers; the historical influence of certain computer designers.
Prerequisite, COINS 502.

540. INTRODUCTION TO AUTOMATA THEORY.

Basic notions of finite automata and Turing machines; finite-state acceptors and regular sets; equivalence relations and system identification; linear sequential circuits; complexity results for finite networks; elementary notions of recursive and recursively enumerable sets.
Prerequisite, COINS 504.

550. COMPUTATIONAL MODELLING.

Introduction to probabilistic techniques as Markov process, Random Walk and Monte Carlo techniques. Statistical techniques, distributions, curve fitting by least squares, correlation coefficients, the method of Chi-square and variances. Brief introduction to simulation languages and analog processes. Selected operations-research models such as simple queues, sequencing and n-person zero sum games. Selected topics generated by class interest from various areas of application.
Prerequisite, COINS 133.

552. TOPICS IN NUMERICAL METHODS.

Computer-oriented numerical analysis, including linear algebra, solution of simultaneous equations, homogenous equations, eigenvectors, solution of differential equations, solution of algebraic and transcendental equations, and functional representations.
Prerequisites, COINS 121, 122 or equivalent; Engr 251.

560. LINGUISTICS AND AUTOMATA.

An introduction to formal language theory in relation to linguistic and psychological studies of the origins, properties, and structure of natural languages; phrase structure and transformational grammars; pushdown, linear-bounded, and stack automata; applications of grammatical descriptions in behavior and pattern description.
Prerequisite, COINS 501.

575. COMBINATORIAL THEORY AND ITS APPLICATIONS.

The solution of problems of enumeration using permutations and combinations, generating functions, and recurrence relations. Introduction to Graph Theory. Linear and dynamic programming. Block designs, difference sets, and orthogonal Latin squares. Applications.
Prerequisites, COINS 501 and 504.

590. ECOLOGICAL CYBERNETICS.

Introduction to the use of cybernetic methods to model ecological systems; first order systems of linear and non-linear difference and differential equations; stability and oscillations in population interactions for n-species eco-structures; stochastic and computer simulation methods of studying population dynamics.
Prerequisite, calculus.

594. COMPUTERS AND SOCIETY.

The uses of computers to solve social problems and the studies required to avoid "side effects"; data banks; computerized voting; automated health care; computer-aided instruction, etc.

595. SEMINAR ON IMPLICATIONS.

Interdepartmental studies of social and economic factors in relation to computer-based solution of large-scale problems. Topic varies from year to year. Credit, 1-6.

IN ADDITION TO THE ABOVE COINS COURSES, STUDENTS ARE ADVISED TO TAKE COURSES IN OTHER DEPARTMENTS, SUCH AS:

Electrical Engineering

510. DIGITAL CIRCUIT THEORY.

642. NON-NUMERICAL PROCESSING.

644. PROGRAMMING STRUCTURES.

660. COMPUTER GRAPHICS.

662. SELF-ORGANIZING SYSTEMS AND PATTERN RECOGNITION.

666. ANALOG AND HYBRID COMPUTERS.

668. ADVANCED SWITCHING THEORY.

702. ALGEBRA AND CODING.

750. GRAPH THEORY AND ITS APPLICATIONS.

Linguistics

703. LINGUISTIC THEORY III.

710. SEMANTICS.

Mathematics

511, 512. INTRODUCTION TO MODERN ALGEBRA

545, 546. APPLIED MATHEMATICS.

551, 552. NUMERICAL ANALYSIS.

557. LINEAR PROGRAMMING AND THEORY OF GAMES.

735. LATTICE THEORY.

745, 746. ADVANCED APPLIED MATHEMATICS.

Philosophy

672, 673. MATHEMATICAL LOGIC.

Psychology

711, 712. SENSORY PROCESSES.

715. PERCEPTION.

725, 726. INFORMATION PROCESSING.

746. QUANTITATIVE METHODS IN PSYCHOLOGY.

750. PHYSIOLOGICAL PSYCHOLOGY.

752. THE NEUROANATOMICAL BASIS OF BEHAVIOR.

753. PSYCHOPHARMACOLOGY.

Zoology

770. COMPARATIVE NEUROPHYSIOLOGY.

Economics

GRADUATE FACULTY

SIMON ROTTENBERG, *Head of the Department of Economics and Professor, B.A.*, George Washington

University, 1939; M.A., Harvard University, 1948; Ph.D., Harvard University, 1950.

NORMAN D. AITKEN, *Assistant Professor*, B.A., University of Cincinnati, 1961; Ph.D., University of Tennessee, 1967.

MICHAEL H. BEST, *Assistant Professor*, B.A., University of Washington, 1963; M.A., University of Oregon, 1967; Ph.D., 1969.

JOHN L. BLACKMAN, JR., *Associate Professor*, B.A., Haverford College, 1930; M.A., 1948; Ph.D., Harvard, 1957.

GALEN D. BURCHARDT, JR., *Director of Graduate Studies in Economics and Assistant Professor*, B.A., University of Washington, 1966; Ph.D., 1970.

JAMES C. COX, *Assistant Professor and Graduate Placement Director*, B.A., University of California-Davis, 1965; M.A., Harvard, 1968; Ph.D., 1970.

THOMAS E. DUSTON, *Assistant Professor*, B.S., University of Maine, 1962; M.A., State University of New York-Binghamton, 1967; Ph.D., Brown University, 1972.

RONALD G. EHRENBERG, *Assistant Professor*, B.A., Harpur College, 1966; M.A., Northwestern University, 1968; Ph.D., 1970.

BRADLEY T. GALE, *Assistant Professor*, B.S., Worcester Polytechnic Institute, 1964; M.A., Massachusetts, 1965; Ph.D., Rutgers, 1968.

GERALD A. GUNDERSON, *Assistant Professor*, B.A., University of Washington, 1962; M.A., 1965; Ph.D., 1967.

VACLAV HOLESOVSKY, *Associate Professor*, Diploma in Political Sciences, University of Paris, 1950; M.A., 1958; Ph.D., Columbia University, 1964.

MARSHALL C. HOWARD, *Professor*, B.A., Princeton, 1941; Ph.D., Cornell, 1951.

RICHARD E. KIHLSSTROM, *Assistant Professor*, B.A., Purdue University, 1964; Ph.D., University of Minnesota, 1968.

JAMES K. KINDAHL, *Professor*, B.A., Chicago, 1951; M.B.A., 1953; Ph.D., 1958.

LEONARD J. MIRMAN, *Assistant Professor*, B.A., Brooklyn College, 1963; M.S., New York University, 1965 (Mathematics); M.S., University of Rochester, 1968 (Economics); Ph.D., 1970.

CADWELL L. RAY, *Assistant Professor*, B.A., Texas A & M, 1959; M.A., 1961; Ph.D., University of Texas, 1967.

VERNON L. SMITH, *Professor*, B.S., California Institute of Technology, 1949; M.A., Kansas, 1951; Ph.D., Harvard, 1955.

HUGO SONNENSCHNEIN, *Professor*, B.A., Rochester, 1961; M.S., Purdue, 1963; Ph.D., 1964.

GEORGE I. TREYZ, *Assistant Professor*, B.A., Princeton University, 1958; Ph.D., Cornell University, 1967.

CHE S. TSAO, *Assistant Professor*, B.S., Chung Hsing University, 1955; M.S., University of Wisconsin, 1964; Ph.D., 1966.

ARTHUR W. WRIGHT, *Assistant Professor*, B.A., Haverford College, 1960; Ph.D., Massachusetts Institute of Technology, 1969.

UNIVERSITY OF MASSACHUSETTS

FIELDS OF STUDY

Programs of graduate study in economics are offered in the following fields of specialization: Economic Theory; Quantitative Methods and Econometrics; Monetary Theory and Policy; Public Finance; Economic History; Economic Development; Industrial Organization and Regulation; Labor Economics; International Economics; Comparative Economic Systems.

THE MASTER OF ARTS DEGREE PROGRAM

Entrance and Admission Requirements

All entering students must have completed at least one semester each of intermediate micro theory, intermediate macro theory, and calculus. All applicants should take the Graduate Record Examination; foreign applicants must take the Test of English as a Foreign Language (TOEFL). Recommendations from professors in economics and mathematics courses are the most useful in reaching admissions decisions.

Degree Requirements

Courses: All candidates for the M.A. are required to complete 36 graduate credits subject to the following restrictions: 12 credits must be earned in 700 to 900 series courses; candidates must take one semester each of microeconomic theory (Econ 701), macroeconomic theory (Econ 705), mathematical methods in economics (Econ 751) and econometrics (Econ 752); 21 of the credits must be taken within the Department of Economics. The candidate must earn grades of B or better in the four required theory courses and maintain a 3.0 average overall.

Optional Thesis: M.A. candidates have the option of submitting a thesis, which counts for between 6 and 9 semester credit hours.

THE DOCTOR OF PHILOSOPHY DEGREE PROGRAM

Entrance and Admission Requirements

Same as for the M.A. Program, plus at least one semester of linear algebra. Persons applying for the Ph.D. program without the M.A. may be required to complete the M.A. program first.

Degree Requirements

Courses: Unless the subject areas are offered as fields on the comprehensive exams (see below), all Ph.D. candidates must take two semesters of econometrics and one semester each of economic history, history of economic thought, and mathematical methods in economics. There is no minimum requirement for semester credits (but see *Dissertation* below).

Comprehensive Examinations: Ph.D. candidates write comprehensive examinations exams in microeconomic theory, macroeconomic theory, and two fields of the candidate's choice. An oral exam may be included as part of the Ph.D. comprehensives, at the request of a written exam grader. Ph.D. comprehensives, which are offered in January, May, and September, may be taken in any order and combina-

tion subject to the following restrictions: all four examinations must be taken at least once by the end of a candidate's third full academic year at the University; candidates studying full time or candidates who receive financial assistance from the University must taken the microeconomic and macroeconomic theory examinations at least once by the end of the second year at the University. The oral exam, if necessary, is normally held after all written exams have been passed; the student normally has two chances to pass each exam. Other conditions for the Ph.D. are as listed under general University requirements.

ALL COURSES CARRY 3 CREDITS UNLESS OTHERWISE SPECIFIED

GRADUATE COURSES

(For either major or minor credit)

(Open to undergraduates with instructor's permission)

700. SPECIAL STUDIES IN ECONOMICS.

Credit, 2-9 each semester.

701 (I), 702 (II). MICROECONOMIC THEORY.

A systematic development of the theory of the consumer, the firm, the industry, and their interactions.

Prerequisite, Econ 203.

Credit, 3 each semester.

Mr. Kihlstrom, Mr. Mirman,

Mr. Sonnenschein, Mr. Wright.

705 (I), 706 (II). MACROECONOMIC THEORY

Nature, construction, and use of social accounting systems. A systematic development of static and dynamic theories of aggregative economic behavior and their applications.

Prerequisites, Econ 212 or 204 or equivalent.

Credit, 3 each semester.

Mr. Burghardt, Mr. Ehrenberg, Mr. Mirman.

711. MONETARY THEORY.

Relationship among the supply of money, interest rates, capital market, price levels and output.

Prerequisite, Econ 705.

712. MONETARY AND FISCAL POLICY.

An analytical treatment of the effects of government and central bank policies intended to achieve such objectives as price stabilization and economic growth.

Prerequisite, Econ 312 or 612 or permission of the instructor.

721. INTERNATIONAL FINANCE.

An analysis of the properties of foreign exchange markets, adjustment mechanisms, speculation, capital flows, and transfer problems; the relationship between balance of payments correctives and domestic policy goals, the balance of payments as a policy problem, and the problem of international liquidity.

Prerequisite, Econ 204 or permission of instructor.

Mr. Aitken.

722. INTERNATIONAL TRADE THEORY.

The pure theory of international trade. The reasons for trade, the gains from trade, factor price equalization, commercial policy, trade and economic development, and customs unions.

Prerequisite, Econ 322 or 622 or permission of instructor.

Mr. Aitken.

731. INDUSTRIAL ORGANIZATION.

A survey of the literature on the market structure, conduct, and performance of industry.

Prerequisite, Econ 203 or 503 or permission of instructor.

Mr. Howard and Mr. Gale.

732. INDUSTRIAL REGULATION.

A survey of the literature on controls extended by government over the business sector of the economy.

Prerequisite, Econ 203 or 503 or permission of the instructor.

Mr. Howard, Mr. Gale.

741. COLLECTIVE BARGAINING.

The legal background of collective bargaining, the process, subject matter, and problems involved. Individual case problems.

Prerequisite, Econ 141.

Mr. Blackman.

743. WAGE THEORY AND COLLECTIVE RELATIONSHIPS.

Theoretical and institutional study of theories of wages and wage structure.

Prerequisite, Econ 141.

Mr. Blackman.

745. LABOR DISPUTE SETTLEMENT.

Ways of settling labor disputes, including grievance proceedings, arbitrations, and presidential intervention.

Given alternate years (not given 1973-74).

Prerequisite, Econ 141.

Mr. Blackman.

746. COMPARATIVE LABOR MOVEMENTS.

Labor movements in various countries with an analysis of their similarities and differences.

Prerequisites, Econ 141 and History 336.

Mr. Barkin.

747. MANPOWER DEVELOPMENT.

A critical examination of current manpower policies and problems. The quantity and quality of manpower resources, problems of labor employment and mobility. Adjustment policies and research tools are reviewed.

Prerequisite, Econ 141.

Mr. Barkin, Mr. Ehrenberg.

751. MATHEMATICAL METHODS IN ECONOMICS.

The various modern applications of mathematics to economic analysis. Both static and dynamic processes. Given as required.

Prerequisites, Econ 301, 251, or equivalent, one year of college mathematics, and permission of instructor.

Mr. Smith, Mr. Sonnenschein.

752 (I), 753 (II). ECONOMETRICS.

The application of modern statistical methods to micro- and macroeconomic theory theory formulated in mathematical terms.

Prerequisite, Econ 251 or permission of instructor.

Credit, 3 each semester. Mr. Kindahl.

761 (I), 762 (II). GENERAL ECONOMIC HISTORY.

Topics in the history of economic activity in the Western world.

Prerequisite, Econ 261.

Mr. Gunderson.

765. ECONOMIC DEVELOPMENT: STRUCTURAL PROBLEMS.

The concept of economic development and the structural changes needed in underdeveloped countries to permit development.

Prerequisite, 15 hours of economics.

766. ECONOMIC DEVELOPMENT: POLICY ISSUES.

Policy decisions involved in efforts of underdeveloped countries to induce development.

Prerequisite, Econ 765.

773. THEORIES OF ECONOMIC SYSTEMS.

The theory of alternative economic systems, of national economic planning, and of resource allocation under different systems.

Prerequisite, Econ 172.

Mr. Holesovsky.

774. SELECTED TOPICS IN SOVIET AND EAST-EUROPEAN ECONOMIES.

Application of advanced economic theory to selected

major problems of planned economies of the Soviet type.
Prerequisites, Econ 172, 173. Mr. Holesovsky.

785. ECONOMIC MODELS OF NATURAL RESOURCES AND THE ENVIRONMENT.
Theoretical economic models of the institutional, technological, and economic features of natural-resource utilization. Economic analysis of public-policy problems. Public control techniques. Some degree of mathematical sophistication required.
Mr. Cox, Mr. Smith.

795. TOPICS IN THEORETICAL WELFARE ECONOMICS.
Recent developments in theoretical welfare economics, following introduction to Pareto optimum conditions in general equilibrium. Properties of allocation mechanisms and their adequacy for achieving Pareto optima. Some degree of mathematical sophistication required.
Prerequisites, Econ 701, 702.
Mr. Smith, Mr. Sonnenschein, Mr. Wright, Mr. Cox.

797. TOPICS IN THE ECONOMICS OF UNCERTAINTY.
Recent developments in the theory and application of expected utility and decision theory. Discussion of experimental studies of choice under uncertainty. Some degree of mathematical sophistication required.
Prerequisite, Econ 701, 702. Mr. Smith, Mr. Cox.

801. HISTORY OF ECONOMIC THOUGHT.
Treatment in depth of various topics within the history of economic thought.
Prerequisite, Econ 306 or permission of instructor.

803 (I), 804 (II). SEMINAR IN ECONOMIC THEORY.
Development of models of economic processes, with emphasis on analysis in depth. Specific subject matter may vary from year to year.
Prerequisites, Econ 701, 702.

Credit, 3 each semester. Mr. Smith.
813 (I), 814 (II). PUBLIC FINANCE.
Theory of public goods and non-market allocation. Normative models of public expenditure and taxation. The integration of equity and efficiency considerations in evaluation of tax-expenditure programs. Social discount rates and shadow prices of resources used in the public sector. The structure and incidence of U.S. taxes. Discussion of tax reform proposals. Fiscal federalism and proposals for federal revenue-sharing.
Prerequisite, Econ 701 or permission of instructor.

Credit, 3 each semester. Mr. Cox.
897 (I), 898 (II). SEMINAR IN QUANTITATIVE ECONOMICS.
For advanced students with interest in econometrics. Weekly seminars are of two kinds: (1) lectures on advanced topics, especially new theoretical developments; (2) discussion of econometric and other empirical studies in process by members of the seminar, by other students and faculty, and by visiting speakers. Emphasis on the use of econometric tools in economic research.
Prerequisite, Econ 753 or permission of instructor.

Credit, 3 each semester. Mr. Gale, Mr. Treyz.

900. DOCTORAL DISSERTATION. *Credit, 15.*

COURSES OPEN TO BOTH GRADUATE AND UNDERGRADUATE STUDENTS
(For either major or minor credit)

ECON 104 is prerequisite to all courses listed below.

505. MARXIAN ECONOMICS.
Exposition of the Marxian economic theory in modern idiom. Comparison of methodological assumptions and

conceptualization of economic phenomena in Marx and in "mainstream economics."
Prerequisite, Econ 103. Mr. Best.

511. MONEY AND BANKING.
The development and operation of the monetary and banking systems of the United States; problems of achieving full employment and price stability through monetary controls.

512. MONEY, INCOME, AND MONETARY POLICY.
The relationships among money, income, and monetary policy, and among individuals, banks, money markets, governments and central banks.
Prerequisite, either Econ 211 or Finance 210.

531. SOCIAL CONTROL OF BUSINESS.
The formal and informal methods and efforts to maintain, supplement, and moderate competition, and the substitution of regulation and public enterprises for competition.
Prerequisite, Econ 103. Mr. Howard.

532. THE STRUCTURE OF AMERICAN INDUSTRY.
Business enterprise, market competition, and economic development in American industries. The social effectiveness of industries analyzed through measures of industrial structure and market performance.
Econ 103 and 203 recommended. Mr. Gordon.

542. LABOR LAW AND LEGISLATION.
Economic effects and historical survey of Federal and state laws and an analysis of important court decisions.
Prerequisite, Econ 141, or permission of instructor.
Mr. Blackman.

552. ECONOMETRICS.
The application of mathematical and statistical methods to economic theory. Emphasis on the application to both microeconomic and macroeconomic policy issues.
Prerequisite, permission of instructor. Mr. Tsao.

561. EUROPEAN ECONOMIC EVOLUTION.
Evolution of economic organization in agriculture, industry, and commerce; the surrounding social and institutional life.
Prerequisites, Hist 100 or 101 or an economics course.

562. AMERICAN ECONOMIC HISTORY.
An analytical approach to structural change, economic growth, and the development of market institutions in the United States from colonial times to the present.
Prerequisite, Econ 100 or 103. Mr. Gunderson.

566. ECONOMIC DEVELOPMENT.
Economic problems of underdeveloped countries and the policies necessary to induce growth. Individual projects required.
Prerequisite, Econ 100 or 103.

567. LATIN AMERICAN ECONOMIC DEVELOPMENT.
Development of the Latin American economies with emphasis on the central problems of the various economies and proposed economic programs.
Prerequisite, Econ 266 or permission of instructor.
Mr. Best.

570. ECONOMICS OF PLANNING.
Theoretical analysis of selected aspects of the Soviet economy: growth models applicable to the Soviet case; problems of measurement of growth and factor productivity; coordination of economic activities through centralized planning and decentralization; investment allocation criteria; conduct of foreign trade; other.
Prerequisites, Econ 103 and 203. Mr. Wright.

571. COMPARATIVE ECONOMIC SYSTEMS.
Evaluation of the performance of alternative economic

systems in theory and practice. Problems of planning in the advanced economies of the United States, Western Europe, and Soviet area.
Prerequisite, Econ 103. Mr. Wright, Mr. Holesovsky.

581. REGIONAL ECONOMICS.

The process of regional economic growth; location theory and basic techniques of regional analysis; public and private area development programs.
Prerequisite, Econ 103; Econ 203 recommended.

Mr. Kane.

601. DECISION THEORY IN ECONOMICS.

The modern theory of rational decision-making under conditions of uncertainty, risk, and conflict. Applications to the theory of the firm and the theory of oligopoly.
Prerequisites, Econ 103 and one year of college math, or permission of instructor.

606. DEVELOPMENT OF ECONOMIC THOUGHT.

Development of economic analysis since 1500. Main currents in the evolution of mercantilistic, Physiocratic, classical, neo-classical, Marxian, and Keynesian economic thought.

612. PUBLIC FINANCE.

Principles of public revenues and expenditures; systems and problems of taxation; use of taxes; expenditures, debt policy to provide full employment; economic growth and price stability.

Prerequisite, Econ 103.

Mr. Cox, Mr. Ray.

614. STATE AND LOCAL PUBLIC FINANCE.

State and local government revenue and expenditure programs. Individual research projects relating to Massachusetts or surrounding states required.
Prerequisite, Econ. 100 or 103.

Mr. Ray.

621. INTERNATIONAL TRADE AND ECONOMIC POLICY

Intermediate theory of international trade, including the analysis of the balance of payments mechanism, pure non-monetary theory and its application to problems of commercial policy.

Prerequisites, Econ 203 and 321.

Mr. Aitken.

638. ECONOMICS OF HEALTH.

Economic aspects of health care and ill-health and social policies relative to health care and prevention of ill-health.

Mr. Morris.

641. ECONOMIC SECURITY.

Public and private programs to prevent or alleviate economic insecurity, including poverty, substandard incomes, and economic contingencies.

645. HUMAN RESOURCE ECONOMICS.

An economic analysis of private and social means for providing access to higher education, housing, medical care, and an improved environment. Poverty, population concentration, and discrimination as barriers to the achievement of these ends. Policies and priorities in human resource development.

Prerequisite, Econ 103 or equivalent.

Mr. Duston.

647. ECONOMICS OF THE LABOR MARKET.

A theoretical and empirical analysis of labor markets, utilizing primarily the tools developed in microeconomics. Topics include the determinants of the personal distribution of income, the level and structure of unemployment, dynamic wage determination, the impact of trade unions and other imperfections in the labor market, and an economic analysis of existing and proposed government legislation or programs which affect the operation of labor market. An introduction to labor-market data and to the formulation and testing of economic models.
Prerequisite, Econ 203.

Mr. Ehrenberg.

673. NATIONAL ECONOMIC POLICIES OF ADVANCED EUROPEAN COUNTRIES AND PROGRAMS.

Evaluates the economic objectives, instruments, measures, and results of economic policy and decision-making mechanisms in the United States in comparison with Norway, Sweden, Netherlands, United Kingdom, Canada, and such other advanced non-socialist countries as the students may select.

Prerequisite, Econ 103.

Mr. Barkin.

682. URBAN ECONOMIC ANALYSIS.

Economic analysis of urban markets and investigation of how urban problems result from the breakdown and imperfections of those markets. Topics include: the urban economy, urban land and housing markets, urban transportation, and the urban public economy.

Prerequisite, Econ 103 or permission of instructor.

Mr. Kane.

Education

GRADUATE FACULTY

DWIGHT W. ALLEN, *Dean of the School of Education and Professor*, B.A., Stanford, 1953; M.A., 1957; Ed.D., 1959.

EARL SEIDMAN, *Associate Dean for Academic Affairs and Associate Professor*, B.A., Oberlin, 1959; M.A.T., Harvard, 1960; Ph.D., Stanford, 1967.

NORMA JEAN ANDERSON, *Assistant Dean for Graduate Affairs and Professor*, B.S., 1956; M.Ed., 1961; Ed.D., Illinois, 1966.

RICHARD J. CLARK, JR., *Assistant Dean for Undergraduate Programs and Associate Professor*, B.A., Amherst, 1960; M.Ed., Harvard, 1961; Ed.D., Stanford, 1969.

ATRON A. GENTRY, *Assistant Dean for Special Programs and Associate Professor*, B.A., California State College at Los Angeles, 1966; Ed.D., Massachusetts, 1970.

BOB SUZUKI, *Assistant Dean for Administration and Associate Professor*, B.S., University of California at Berkeley, 1960; M.S., 1962; Ph.D., California Institute of Technology, 1967.

CLEO ABRAHAM, *Assistant Professor*, B.A., Claflin, 1964; M.S., Southern Connecticut State College, 1968; Ed.D., Massachusetts, 1971.

ALFRED S. ALSCHULER, *Professor*, B.A., Amherst, 1961; M.A., Harvard, 1963; Ph.D., 1967.

ERNEST C. ANDERSON JR., *Associate Professor*, B.A., Amherst, 1950; M.A.T., Harvard, Ed.D., 1966.

WILLIAM M. ANDRES, *Lecturer*, B.A., Boston, 1965; M.F.A., Ohio, 1971.

ALBERT S. ANTHONY, *Professor*, B.S., Trinity, 1937; M.A.T., Harvard, 1941; Ed.D., 1955.

KENNETH H. BLANCHARD, *Associate Professor*, B.A., Cornell, 1961; M.A., Colgate, 1963; Ph.D., Cornell, 1966.

LINDA-SUE BLANE, *Assistant Professor*, B.A., Miami, 1963; M.S., 1965; Ed.D., Florida, 1967.

STEPHEN M. BLANE, *Assistant Professor*, B.A. Miami, 1960; M.Ed., 1965; Ed.D., Florida, 1967.

RAY BUDDÉ, *Assistant Professor*, B.S., St. Louis, 1943; M.Ed., Illinois, 1947; Ed.D., Michigan State, 1958.

RICHARD M. BUNKER, *Assistant Professor*, B.S., Farmington State, 1959; M.Ed., Maine, 1965; Ed.D., Illinois, 1970.

EMMA M. CAPPELLUZZO, *Associate Professor*, B.S., Boston, 1955; M.Ed., Arizona, 1959; Ed.D., 1965.

DONALD CAREW, *Professor*, B.A., Ohio, 1955; M.A., 1956; Ed.D., Florida, 1962.

JAMES F. CARMODY, *Assistant Professor*, B.S., University of Otago at Dunedin, New Zealand, 1966; Ph.D., Iowa, 1971.

F. THOMAS CLARK, *Assistant Professor*, B.A., Allegheny College, 1962; M.A., 1964; Ed.D., Cornell University, 1967.

DAVID G. COFFING, *Associate Professor*, B.A., Iowa, 1951; M.A., San Francisco State, 1964; Ed.D., Stanford, 1971.

WILLIAM J. CONWAY, *Assistant Professor*, B.S., Northwestern, 1949; B.S., Kent State, 1950; M.Ed., Massachusetts, 1970; Ed.D., 1971.

REGINALD G. DAMERELL, *Associate Professor*, B.A., Columbia College, 1946.

DAVID E. DAY, *Associate Professor*, B.S., State University of New York at Brockport, 1952; M.S., 1958; Ed.D., Wayne State, 1962.

PHILIP H. DETURK, *Assistant Professor*, B.A., Dartmouth, 1954; M.A., Columbia, 1956; Ed.D., Massachusetts, 1971.

H. TODD EACHUS, *Assistant Professor*, A.B., California, 1961; M.A., Nevada, 1962; Ed.D., Massachusetts, 1969.

S. PHILIP EDDY, *Assistant Professor*, B.A., State College at Wayne, Nebraska, 1951; M.A., Columbia, 1951.

JEFFREY W. EISEMAN, *Assistant Professor*, B.A., Stanford, 1962; M.A., Michigan, 1964; Ph.D., 1971.

KENNETH A. ERTEL, *Professor*, B.S., Minnesota, 1953; M.Ed., Eastern Washington College of Education, 1960; Ed.D., Washington State, 1967.

DAVID R. EVANS, *Assistant Professor*, B.S., Oberlin, 1959; M.S., Illinois, 1961; Ph.D., Stanford, 1969.

ARTHUR W. EVE, *Associate Professor*, B.Ed., Chicago Teachers College, 1957; M.A., Chicago, 1961; Ph.D., 1967.

WILLIAM V. FANSLAW, *Associate Professor*, A.B., Chapman College, 1959; M.A., Stanford, 1961; Ph.D., 1967.

LOUIS FISCHER, *Professor*, B.A., Stanford, 1949, LL.B., 1951; M.A., 1954; Ph.D., 1958.

DAVID FLIGHT, *Assistant Professor*, B.A., Pennsylvania, 1950; M.A., Columbia, 1956; Ph.D., Chicago, 1969.

DOUGLAS R. FORSYTH, *Assistant Professor*, B.A., Bucknell, 1960; M.A., 1962; Ph.D., Colorado State, 1968.

JIMMIE C. FORTUNE, *Professor*, B.A., Southwestern at Memphis, 1956; M.A., Memphis State, 1960; Ed.D., Stanford, 1965.

RONALD H. FREDERICKSON, *Associate Professor*, B.S., Kansas State Teachers, 1953; M.S., 1959; Ph.D., 1963.

WILLIAM GORTH, *Assistant Professor*, B.A., State University of New York at Buffalo, 1964; Ph.D., Stanford University, 1971.

WILLIAM E. GRIFFITHS, *Associate Professor*, B.A., Pennsylvania State, 1949; M.Ed., 1950; Ed.D., Pennsylvania, 1963.

RICHARD F. HAASE, *Assistant Professor*, B.S., Occidental, 1963; M.S., California State at Los Angeles, 1965; Ph.D., Colorado State, 1968.

DONALD E. HALL, *Assistant Professor*, B.S., Gorham Teachers, 1954; M.Ed., 1955; Ed.D., Boston, 1965.

RONALD K. HAMBLETON, *Assistant Professor*, B.A., University of Waterloo, 1966; M.A., Toronto, 1967; Ph.D., 1969.

GLENN W. HAWKES, *Assistant Professor*, B.A., Wesleyan, 1961; M.A.T., Harvard, 1962; Ed.D., Harvard, 1968.

JACK HRUSKA, *Assistant Professor*, B.A., Michigan State, 1956; M.A., Colorado State College, 1960; Ph.D., Michigan State, 1969.

THOMAS E. HUTCHINSON, *Associate Professor*, B.A., Rutgers, 1959; M.Ed., Boston University, 1961; Ed.D., Harvard, 1969.

ALLEN E. IVEY, *Professor*, B.A., Stanford, 1955; Ed.D., Harvard, 1959.

BYRD L. JONES, *Professor*, B.A., Williams, 1960; Ph.D., Yale, 1966.

ROBERT C. JONES, *Assistant Professor*, B.S., Maine, 1937; M.S., Massachusetts, 1953; Ed.D., Cornell, 1960.

DANIEL C. JORDAN, *Professor*, B. Mus., Wyoming, 1954; B.A., Oxford, 1959; M.A., Chicago, 1960; Ph.D., 1964.

GLORIA I. JOSEPH, *Associate Professor*, B.S., New York University; M.S., City College of New York; Ph.D., Cornell, 1967.

SIMON KEOCHAKIAN, *Assistant Professor*, B.S., Springfield College, 1958; M.S., Springfield College, 1961; Ed.D., Massachusetts, 1970.

A. DONN KESSELHEIM, *Professor*, B.A., Stanford, 1948; M.A., Colorado State, 1951; Ed.D., Harvard, 1964.

RICHARD D. KONICEK, *Assistant Professor*, B.S., Illinois, 1963; M.S., 1954; Ed.D., Columbia, 1967.

WILLIAM G. KORNEGAY, *Professor*, B.A., North Carolina, 1949; M.Ed., 1957; Ph.D., 1959.

RUSSELL KRAUS, *Assistant Professor*, B.A., Paterson State, 1963; M.S., Southern Illinois, 1969; Ed.D., Massachusetts, 1971.

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SUSAN C. LAFRANCE, *Assistant Professor*, B.A., Drew, 1962; M.A., Temple, 1963; Ph.D., Massachusetts, 1967.

WILLIAM LAUROESCH, *Associate Professor*, B.A., Colgate, 1942; M.A., Syracuse, 1947; Ed.D., New York, 1956.

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WILLIAM J. MASALSKI, *Assistant Professor*, B.S., Central Connecticut State, 1956; M.A., Fairfield, 1960; Ed.D., Massachusetts, 1970.

RHODY MCCOY, *Associate Professor*, B.S., Howard, 1947; M.A., New York, 1949; Ed.D., Massachusetts, 1971.

ROBERT J. MILTZ, *Assistant Professor*, B.A., Stanford, 1964; M.A., Stanford, 1965; Ed.D., Stanford, 1971.

ROGER H. PECK, *Assistant Professor*, B.S., Taylor, 1960; M.Ed., Miami (Ohio), 1965; Ph.D., Ohio State, 1969.

HOWARD A. PEELE, *Assistant Professor*, B.S., Swarthmore, 1965; Ed.D., Massachusetts, 1971.

FREDERICK R. PRESTON, *Assistant Professor*, B.S., Hartford, 1967; Ed.D., Massachusetts, 1971.

HORACE B. REED, *Professor*, B.A., Antioch, 1943; M.S., Putney Graduate School of Teacher Education, 1953; Ed.D., Harvard, 1959.

MARK H. ROSSMAN, *Assistant Professor*, B.A., Washington Square, 1963; M.S., Bridgeport, 1966; Ed.D., Massachusetts, 1971.

MASHA RUDMAN, *Assistant Professor*, B.A., Hunter, 1953; M.S., 1956; Ed.D., Massachusetts, 1970.

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DAVID M. SCHIMMEL, *Associate Professor*, B.A., Duke, 1955; LL.B., Yale, 1958; B.H.L., Hebrew Union, 1967.

SIDNEY B. SIMON, *Professor*, B.A., Pennsylvania State, 1949; M.Ed., 1952; Ed.D., New York, 1958.

ROBERT L. SINCLAIR, *Assistant Professor*, B.S., Miami, 1960; M.E., 1961; Ed.D., University of California at Los Angeles, 1968.

PATRICK J. SULLIVAN, *Associate Professor*, B.A., Georgetown, 1960; M.A., University of California at Berkeley, 1962; Ph.D., 1967.

HARIHARAN SWAMINATHAN, *Assistant Professor*, B.S., Dalhousie, 1965; M.S., Toronto, 1966; M.Ed., 1968; Ph.D., 1971.

LEVERNE J. THELEN, *Associate Professor*, B.S., Nebraska State at Wayne, 1949; M.A., Nebraska, 1956; Ed.D., 1961.

WILLIAM L. TUTMAN, *Associate Professor*, B.S., Morgan State, 1956; M.A., 1961.

RICHARD O. ULIN, *Professor*, B.A., Harvard, 1938; M.A., 1942; M.Ed., 1949; Ed.D., 1958.

GEORGE E. URCH, *Assistant Professor*, B.A., Western Michigan, 1953; M.A., 1959; Ph.D., Michigan, 1967.

PETER H. WAGSCHAL, *Assistant Professor*, B.A., Harvard, 1966; M.A., Stanford, 1967; Ed.D., Massachusetts, 1969.

ERNEST WASHINGTON, *Associate Professor*, B.A., Minnesota, 1960; M.A., Illinois, 1965; Ph.D., 1968.

GERALD WEINSTEIN, *Professor*, B.S., Temple, 1954; M.Ed., 1959.

ROBERT R. WELLMAN, *Associate Professor*, B.A., Dartmouth, 1954; M.A., Western Reserve, 1959; Ph.D., Ohio State, 1962.

JOHN W. WIDEMAN, *Assistant Professor*, B.A., Williams College, 1950; M.Ed., 1956; Ed.D., 1970.

ROLAND A. WIGGINS, *Assistant Professor*, B.A., 1960; M.A., 1962; Mus.D., Combs College of Music, 1965.

MARY ALICE B. WILSON, *Lecturer*, B.A., Radcliffe, 1958; M.A., University of California at Berkeley, 1961; Ed.D., Massachusetts, 1970.

WILLIAM C. WOLF, JR., *Professor*, B.S., Pennsylvania State at Kutztman, 1955; M.Ed., Ohio, 1956; Ph.D., Iowa, 1959.

ROBERT L. WOODBURY, *Associate Professor*, B.A., Amherst, 1960; M.A., Yale, 1962; Ph.D., 1966.

ROBERT H. WUERTHNER, *Assistant Professor*, B.A., Wesleyan, 1958; M.A., Colgate, 1963; Ph.D., Cornell, 1971.

RAYMOND WYMAN, *Professor*, B.S., Massachusetts, 1937; M.Ed., Boston, 1947; D.Ed., 1956.

DAVID J. YARINGTON, *Assistant Professor*, B.A., Duke, 1960; M.Ed., Cornell, 1961; Ed.D., Pennsylvania, 1968.

THE DOCTOR OF EDUCATION DEGREE PROGRAM

Typically an Ed.D. candidate spends at least three years beyond the bachelor's degree in full-time study. Within the framework of Graduate School regulations, each student plans his own doctoral program with the advice of and subject to the approval of a Guidance Committee. Students are expected to spend at least two consecutive semesters under direct supervision of their committees, participate in conceptual or quantitative research efforts, engage in teaching and/or some form of field experience, become familiar with contemporary problems in education, and take a comprehensive examination prior to writing a dissertation.

THE MASTER OF EDUCATION DEGREE PROGRAM

The Master of Education degree is offered for prospective elementary teachers, for professional improvement of elementary and secondary teachers, and for the training of educational specialists in any of the Areas of Concentration listed below. Each candidate prepares a 33-credit program in consultation with an adviser.

THE MASTER OF ARTS IN TEACHING DEGREE PROGRAM

The M.A.T. is a cooperative program between the various Colleges and Schools of the University and the School of Education. The program for elementary and secondary school teaching is intended primarily for graduates of approved liberal arts institutions who have had little or no course work in professional education. The program for community-college teaching prepares graduates of approved liberal arts, engineering, business, and public health institutions for teaching programs needed in the community/junior college.

CERTIFICATE OF ADVANCED GRADUATE STUDY (C.A.G.S.)

Programs leading to a Certificate of Advanced Graduate Study, individually prepared in consultation with a member of the instructional staff, are

designed for those persons who seek post-master's degree work in any of the areas listed below, but who are not committed to the more lengthy and rigorous requirements of a doctoral program. These are not degree programs, but require a minimum of 30 credit hours beyond the master's degree. All 30 credits must be taken at the University of Massachusetts within a four-year period, and at least 15 credits must be taken in the School of Education. Of all the course work leading to the Certificate, at least 18 credits must be in 700-900 courses.

THE SCHOOL OF EDUCATION

The School of Education is committed to developing and evaluating new structures, programs, and perspectives which hopefully will lead to major reforms in education. It is a school that is attempting to become a powerful force for changing education to meet more effectively students' needs for living in today's world and society's needs for education to improve the quality of life for all its members.

LEARNING CENTERS

The general academic program is characterized by a diversity of learning and teaching resources, alternative education paths, and emphasis on active involvement. The academic structure of the School builds on and reinforces these concepts through the use of learning centers which operate as focal points for the various academic experiences and courses. Centers differ from traditional departments in several respects: faculty and students may belong to more than one center; although a student typically but not necessarily may have an academic emphasis in a given center, the degree is not awarded through that center but through the School as a general Education degree; centers themselves are not permanent but are subject to an evaluation every three years.

Examples of current centers include: Center for the Study of Aesthetics in Education; Center for Foundations of Education, Higher Education Center, Center for the Study of Human Potential, Human Relations Center, Center for Humanistic Education, Center for the Study of Educational Innovations, Center for International Education, Center for Leadership in Administration, Media Center, Center for Occupational Education, Center for Educational Research, Center for Teacher Educators, Center for Urban Education.

The School operates under a pass/fail grading system. (Master's degree candidates, however, are required to earn 15 of 33 credits on a graded basis.)

ALL COURSES CARRY 3 CREDITS UNLESS OTHERWISE SPECIFIED

COURSES OPEN TO GRADUATE STUDENTS ONLY

(For either major or minor credit)

700. SPECIAL PROBLEMS IN EDUCATION.
A critical study of some problem in the educational field.
Credit, 1-4.

701. PRACTICUM FOR SCHOOL GUIDANCE.
Prerequisites, Education 577, 910, and 911. *Credit, 1-4.*

702. INDEPENDENT STUDY. *Credit, 1-12.*

UNIVERSITY OF MASSACHUSETTS

705. SEMINAR IN EDUCATION.
An intensive analytical study of some phase of education.
Credit, 3-12.

706. SEMINAR IN GUIDANCE.
(Master's Section)

707. SEMINAR IN GUIDANCE.
(Doctoral Section)

708. SEMINAR IN GIFTED STUDENTS.

709. SEMINAR IN READING.

710. SEMINAR IN MATHEMATICS EDUCATION.

711. SEMINAR IN SOCIAL STUDIES EDUCATION.

712. ENGLISH FOR THE DISADVANTAGED.
The special problems in teaching English in secondary schools where students come largely from culturally and economically disadvantaged backgrounds.

713. HUMAN APPRAISALS AND EVALUATION.
Analysis of statistical procedures; review of achievement, aptitude, and interest tests, and their interpretation, selection, and administration; case-study procedures; ethical consideration; and problems in human assessment. Prerequisite, permission of instructor.

714. SEMINAR IN ENGLISH EDUCATION.

715. WORKSHOP IN EDUCATION.
Group study of practical problems in curriculum, instruction, and administration for school personnel in service.
Credit, 2-6.

716. WORKSHOP IN REMEDIAL READING.

717. WORKSHOP IN GIFTED STUDENTS.

718. COUNSELING AND GUIDANCE THEORY AND PROCEDURE.
The general nature of theory construction; levels of explanation; relationships of philosophy, psychology, and sociology; and various methods of facilitating human growth and development. Prerequisite, permission of instructor.

719. WORKSHOP IN KINDERGARTEN.

720. WORKSHOP IN GUIDANCE.

721. WORKSHOP IN LANGUAGE ARTS.

722. WORKSHOP IN EDUCATIONAL ADMINISTRATION (PRINCIPALS).

723. WORKSHOP IN EDUCATIONAL ADMINISTRATION (ADMINISTRATORS).

724. DOCTORAL SEMINAR IN INTERNATIONAL EDUCATION.
An integrating core experience for doctoral students in international education. Current issues and areas of competency needed in the field.

725. EXTERNSHIP IN BUSINESS AND INDUSTRY.
Supervised field experience in industry, business, research organizations, or public agencies relevant to the student's area of specialization. Planned individually by student, cooperating business and vocational-technical education staff prior to enrollment.

727. PHOTOGRAPHY IN EDUCATION.
Theory and practice of taking and processing photographs for use in educational activities.

728. AUDIOVISUAL TECHNOLOGY.

Applications of acoustics, electricity, magnetism, mechanics, and optics to audio-visual equipment and techniques.

Prerequisite, Educ 667.

729. RESEARCH METHODOLOGY IN INTERNATIONAL EDUCATION.

An introduction to research methods; students enabled to design and carry out field studies in international education. Techniques used in the various social sciences and examples of their application to problems in international education. Survey methods, attitude and value analysis, interviewing and participant-observation techniques, and research design. Models of design and techniques presented for critique. Each student sets up a research design and method outline for a specific project.

730. MEASUREMENT FOR GUIDANCE.

Analysis of measurement devices in school guidance, including sociometrics, value scales, inventories, and other tests.

731. INTRODUCTION TO FACTOR ANALYSIS.

An introductory treatment of the linear factor model consideration of the basic problems of factor analysis and a discussion of various factor-analytic solutions. Problems of design and interpretation discussed.

Prerequisite, permission of instructor.

734. TRADITIONAL SYSTEMS OF EDUCATION.

Theories and principles of selected traditional educational systems throughout the world. The goals, organizational structures, curricula, and methods of education examined in relation to the salient features of each culture and in comparison to present systems. Attempts to illustrate the constraint or facilitation of educational system development by these elements and to discover clues for improving education.

735. TEST THEORY.

The theory of mental tests beginning with the classical test theory model and including such topics as reliability, validity, item analysis, and latent structure models.

Prerequisite, permission of instructor.

736. SEMINAR IN CURRICULUM DEVELOPMENT IN VOCATIONAL-TECHNICAL EDUCATION.

Curriculum development approached from the standpoint of problem areas and embodying current research and response to social or technical changes.

738. ADVANCED MEDIA PRODUCTION.

Professionals preparation in the area of education media and technology.

739. VISUAL COMMUNICATIONS AND LITERACY.

The elements of visual literacy and of programs of visual education.

743. HISTORY OF EUROPEAN EDUCATION.

Educational movements and institutions traced from early Greece to the present in Europe, in an attempt to understand modern problems better.

744. HISTORY OF HIGHER EDUCATION IN AMERICA.

An inquiry into the role of the college and university in American society in the past as well as the present. Special attention to the meaning of a college education at various periods in American life.

745. INQUIRY INTO AMERICAN SCHOOLING.

Contemporary educational practices. Emphasis on promising developments in curriculum, staffing, and organization of public schools; past and future innovations.

747. COUNSELING AND GUIDANCE STRATEGIES.

Individuals, groups, and institutions, with their relevance to counseling and guidance. Emphasis on the implementation of the knowledge acquired. Supervised laboratory course open only by written permission of instructor.

748. THE TWO-YEAR COLLEGIATE INSTITUTION IN AMERICAN EDUCATION.

The evolution of variant forms of two-year degree-granting institutions with attention to related philosophical and social issues.

750. THE UNIVERSITY: AN ORGANIZATIONAL ANALYSIS.

The effects of institutional organization in higher education on human behavior.

751. INDIVIDUAL ALIENATION AND CONTEMPORARY HIGHER EDUCATION.

An analysis based on interdisciplinary readings on student alienation in contemporary institutions of higher education.

765. ORGANIZATION FOR CURRICULUM DEVELOPMENT: BASIC PRINCIPLES IN CURRICULUM AND INSTRUCTION.

The procedures and criteria for curriculum development. Determining goals, creating and organizing learning opportunities, and evaluating the effectiveness of curricula, considered in a small group setting.

766. CURRICULUM DEVELOPMENT: THEORY AND RESEARCH.

The needs of children and society; modern programs; procedures for developing curricula and improving present offerings in a school. Includes clinical involvement in curriculum development in schools cooperating with the Center for Study of Educational Innovations.

768. DEVELOPMENTS IN ELEMENTARY SCIENCE EDUCATION.

A survey of recent research in elementary science education and the resultant implications for practice in the school.

Prerequisite, Educ 562 or 661.

769. EVALUATION OF CURRICULUM PROGRAMS.

The role of evaluation in curriculum development and the development of evaluative instruments. The nature of the educational environment of schools and the need for determining what makes a compelling curricular program.

Prerequisites, Educ 765 and 766.

780. RESEARCH IN READING.

Discussion and review of relevant research and development activities in reading, past, present, and future, including an analysis of the research-to-implementation process and an investigation into possible breakthroughs in reading instruction.

Prerequisite, permission of instructor.

781. TEACHING OF READING ON SECONDARY AND ADULT LEVELS.

Principles, methods, and materials for the teaching of developmental, remedial, and accelerated reading programs. For teachers at the junior and senior high school level and for leaders of adult and college reading programs.

782. CHILDREN'S LITERATURE.

Lectures, demonstrations, discussions, practicum and readings surveying the field. Investigates various content areas (such as comparative folklore, poetry, and non-

fiction), approaches for classroom use, contemporary problems, and the needs of specific populations.

783. DIAGNOSIS OF READING DIFFICULTIES.
Develops a background of information in the diagnosis and treatment of reading difficulties. Theory and interpretation of diagnostic procedures.
Prerequisite, Educ 561.

784. INDIVIDUAL CASE STUDIES OF READING PROBLEMS.
Practical experience in the gathering and summation of information to form a case study of a child that may be used to determine the seriousness and the underlying causes of the reading problem and to make recommendations for correction or remediation.
Prerequisite, Educ 783.

785. TECHNIQUES IN REMEDIAL READING.
Methods and materials in diagnosis and remedial instruction.
Prerequisite, Educ 561.

810. THE LANGUAGE AND LOGIC OF TEACHING.
The limits and resources of language including logic, definitions, and rhetoric as they apply to teaching.

811. RECENT DEVELOPMENTS IN SECONDARY SCIENCE.
The scope and sequence of the science curriculum; the rationale, content, and implications for different student populations of selected curricula.
Prerequisite, teaching experience.

812. RECENT DEVELOPMENTS IN SECONDARY ENGLISH.
A critical evaluation of the current literature, research, yearbooks, and experiments in the curriculum and teaching of English.
Prerequisite, Educ 609.

813. RECENT DEVELOPMENTS IN SECONDARY SOCIAL STUDIES.
A comparative study and evaluation of recent programs and practices in secondary school social studies.

814. RECENT DEVELOPMENTS IN SECONDARY MATHEMATICS.
A critical evaluation of the current literature, research, and studies in the curriculum and teaching of secondary school mathematics.
Prerequisites, Educ 611 and teaching experience.

815. SECONDARY SCHOOL CURRICULUM.
The factors influencing the secondary school curriculum, the organization of the curriculum, and the goals of the secondary school, and current developments and elements desirable in the curriculum of typical secondary schools.
Prerequisite, teaching experience or permission of instructor.

816. TECHNOLOGY AND EDUCATIONAL DEVELOPMENT.
Modern technology and educational innovations and their adaptations to problems of developing countries. Students expected to design a project for implementing given innovations in the context of a particular country.

817. TECHNIQUES OF EDUCATIONAL PLANNING FOR DEVELOPING COUNTRIES.
For advanced doctoral majors in educational development. Some of the basic techniques of educational planning as they are currently being used in Europe and developing areas of the world. Students expected to carry out a planning exercise for a given school system.

819. MAJOR DOCUMENTS IN SECONDARY EDUCATION.
In-depth study of the most influential studies, reports, and experiments in the development of secondary education in the United States.

820. RESEARCH PRACTICUM IN EDUCATION.
Educational problems examined in varied field settings. Alternative solutions contemplated in the context of schools, state agencies, and federally-sponsored projects. Consultative arrangements made for students; discussions and field work.

830. EDUCATION AND NATION BUILDING.
The educational problems facing developing nations as they endeavor to use the schools as an ameliorative agent. Economic factors and political considerations influencing educational planning in divergent cultures; the allocation of educational resources and the confrontation between old and new cultural values.

833. EDUCATIONAL KNOWLEDGE DIFFUSION AND UTILIZATION.
Efforts to diffuse and utilize research in agriculture, medicine, the military, the social sciences, and commerce. Parallels between patterns in these fields and in education. Models of educational diffusion and utilization. Discussion and field work.

835. SPECIAL SEMINAR IN HUMANISTIC EDUCATION.
A reading seminar exploring the philosophy, social psychology, and purposes of humanistic education. Discussion to clarify the objectives and goals of humanistic education.
Prerequisites, Educ 522 and 678, and permission of instructor.

839. HISTORY AND THE SOCIAL SCIENCES: AN INTERDISCIPLINARY APPROACH.
The possibilities for developing viable interrelationships in secondary school instruction between history and the various social sciences.

849. CURRENT CONCEPTS, TRENDS, AND PRACTICES IN VOCATIONAL-TECHNICAL EDUCATION.
Concepts resulting from a critical evaluation of the research and legislation involved in the development of vocational and technical education programs.

850. AUTO-INSTRUCTIONAL DEVICES AND PROGRAMMED LEARNING.
Theory and practice of programmed learning for typical school subjects. Each student sets up objectives and constructs a program for a unit of work. Implications for future use in education are considered.
Prerequisite, Educ 667.

852. ADMINISTRATION OF AUDIOVISUAL SERVICES.
To prepare audiovisual coordinators, directors, and supervisors in the operation of an audiovisual service: teacher-training, selection of materials and equipment, storage, cataloging, distribution, maintenance, and financial support.
Prerequisites, Educ 667 and teaching experience.

854. NEWER MEDIA IN EDUCATION.
To acquaint administrators, supervisors, and experienced classroom teachers with the characteristics, applications, and implications of the newer media in education such as language laboratories, motion pictures, closed circuit television, and teaching machines.
Prerequisite, Educ 667 or permission of instructor.

870. SPECIAL PROBLEMS IN INTERNATIONAL EDUCATION.

Independent work in international education.

Credit, 1-6.

880. CURRENT ISSUES IN EDUCATION.

In-depth exploration of historical antecedents, present conditions, and future alternatives. Fulfills the "Foundations" requirement for students seeking teacher certification.

881. COMPARATIVE EDUCATION.

The processes and problems of educational development in selected areas throughout the world. The interrelationship between education and culture explored in a multicultural context. While historical antecedents are recognized, major emphasis is on the cultural forces responsible for contemporary educational practices. Fulfills "Foundations" requirement for students seeking teacher certification.

884. EDUCATIONAL SOCIOLOGY.

The American public schools examined as one of many social institutions in the American culture. Emphasis on population, pressure groups, and the social structure of the schools within the community. Optional field experience. Fulfills "Foundations" requirement for students seeking teacher certification.

890. ANCIENT AND MEDIEVAL EDUCATIONAL THOUGHT.

Representative educational thinkers during the ancient and medieval periods.

891. MODERN EDUCATIONAL THOUGHT.

Representative educational thinkers of this era.

900. DOCTORAL DISSERTATION. *Credit, 15-30.*

910. SCHOOL COUNSELING THEORY.

Counseling theory and research evaluation. Methodology, philosophies, ethics, problems, and issues of school counseling.

Prerequisites, Educ 577 and at least one hour of credit in Educ 701.

911. SCHOOL COUNSELING PROCEDURES.

Instruments and techniques of guidance, such as observation, individual appraisal, and record-keeping, and school-community liaison practices.

Prerequisites, Educ 577 and 910.

912. OCCUPATIONS AND PLACEMENT IN SCHOOL GUIDANCE.

The collection and evaluation of occupational, educational, and placement information, and its use with individuals and groups of students in school guidance.

Prerequisite, Educ 577.

913. ADMINISTRATION OF SCHOOL GUIDANCE SERVICES.

Operative framework of guidance programs in terms of personnel, functions, physical facilities, institutional integration, finance, and data processing. To be taken near completion of master's degree.

Prerequisite, Educ 577.

914. STUDENT PERSONNEL SERVICES IN HIGHER EDUCATION.

Origin, growth, and operation of student personnel services in American colleges and universities. Specific personnel services such as selection and admission of students, orientation to college life; student financial aid, student activities, and discipline.

Prerequisite, Educ 577.

915. GROUP ACTIVITIES IN GUIDANCE.

A guidance study of school groups. Group dynamics,

discussion techniques, group counseling, sociometric methods, and other school group activities.

Prerequisites, Educ 577, 910, and 911.

916. CLINICAL STUDIES IN SCHOOL GUIDANCE.

Intensive case studies of youth.

Prerequisite, Educ 911 or 730.

918. SEMINAR IN RESEARCH METHODOLOGY FOR INTERNATIONAL EDUCATION.

An advanced seminar in research methods for doctoral candidates about to begin field work. Discussion and analysis of dissertation proposals. Normally taken by second and third year doctoral students in international education.

928. INTERNSHIP IN SCHOOL GUIDANCE AND COUNSELING.

Supervised on-the-job counseling experience including direct counseling, individual supervisory conferences, writing of case reports, and analysis of taped counseling sessions. To be taken near completion of CAGS or doctoral program.

Prerequisite, permission of instructor.

Credit, 3-6.

929. ADJUSTMENT COUNSELING CASEWORK.

Supervised experience with children having special adjustment problems. May not be taken in addition to Educ. 928.

949. CAREER DEVELOPMENT.

Intensive study of theories of vocational choice, related literature and research. Analysis of world of work and impact of such factors as technology, demography, social structure, geography, automation, age, and sex on career and personal development; implications for educational institutions.

950. FUNDAMENTALS OF EDUCATIONAL ADMINISTRATION.

Introduction to general school administration, the relation of public education to the cultural pattern, and organization and practices in school administration.

951. PRINCIPLES OF SUPERVISION.

Principles and problems of supervision and the exercise of educational leadership to improve instruction in the elementary curriculum and in secondary school content fields.

952. ADMINISTERING ELEMENTARY SCHOOLS.

The principal's responsibilities, organization of the school office, scheduling, use of school facilities, curriculum organization, staff relationships, and the place of the school in the community.

Prerequisite, teaching experience.

953. ADMINISTERING SECONDARY SCHOOLS.

Housing, finance, scheduling, the library, guidance, cafeteria, public relations, etc.

Prerequisite, teaching experience.

954. PUBLIC SCHOOL FINANCE.

The economics of public education, sources of school revenue, taxation, and federal, state and local plans of school fiscal support.

Prerequisite, Educ 950.

955. COMMUNITY RELATIONS FOR SCHOOL PERSONNEL.

The development of good public-relations policies and techniques for assisting lay people in interpreting school activities, policies, and objectives.

Prerequisite, permission of instructor.

956. PRINCIPLES OF SCHOOL LAW.

Review of the legal relations of school personnel in school and community. A series of selected cases.

957. LEGAL BASIS OF SCHOOL ADMINISTRATION.

The legal basis of school operation, cases in school law, the role of the attorney general and school solicitor in school law interpretation, and school operation in relation to federal, state, and local environment.
Prerequisite, Educ 950.

958. SCHOOL PERSONNEL ADMINISTRATION.

The leadership role in staff performance and duties, the planning and promotion of continuous programs of in-service training, and personnel recruitment and development.
Prerequisite, Educ 950.

959. SCHOOL BUSINESS ADMINISTRATION.

The business aspects of school administration as related to the attainment of educational objectives. The nature of the problems involved and the skills needed in directing school business affairs.
Prerequisite, Educ 950.

960. SCHOOL PLANT PLANNING.

A comprehensive study of school plant needs, site selection, bonding, building planning, and standards, architectural service, and furniture and equipment selection practices.
Prerequisite, Educ 950.

961. CASE STUDIES IN EDUCATIONAL ADMINISTRATION.

A series of situations involving the role of the school administrator in a democracy.
Prerequisites, Educ 950 and 958.

962. EDUCATIONAL PLANNING AND EVALUATION.

Participation in a school survey to give advanced graduate students practical field experience in inspection evaluation and recommendations for future action in the educational operation.
Prerequisites, Educ 950, 959, 960, and permission of instructor. Taught in two consecutive semesters. *Credit, 6.*

963. INTERNSHIP IN EDUCATIONAL ADMINISTRATION.

For advanced graduate students in educational administration. Placement on assignment in actual school administration positions on the basis of cooperative school system-university selection, assignment, and supervision.
Prerequisites, 18 semester hours in educational administration and permission of instructor. *Credit, 6-12.*

964. ADMINISTRATION OF ADULT EDUCATION.
Role of the public schools in continuing community service and planning and directing programs in adult education; adult needs in preparation for job procurement, retraining, job advancement, and community service.
Prerequisite, Educ 950.

965. THEORY AND RESEARCH IN EDUCATIONAL LEADERSHIP.

The historical development of administrative theory. Emphasis on its contribution to research and development in educational administration.
Prerequisite, Educ 950.

COURSES OPEN TO BOTH GRADUATE AND UNDERGRADUATE STUDENTS
(For either major or minor credit)

515. THEORY AND PRACTICE IN INTERVIEWING.

The dynamics of interviewing, theoretical bases for conducting interviews, types of interviews, research in

interview behavior, and data-gathering procedures. Practice and field work.

516. EVALUATION MODELS.

Seminar utilizing the writings of Guba, Stufflebeam, Stake, Pace, Serevin, Bloom, and Hammond. Emphasis on philosophies of evaluation, variables employed in the various models, and the generation of new evaluation designs.
Meets twice weekly for six weeks, three hours per meeting.

518. RESEARCH METHODS IN EDUCATION.

An interdisciplinary course on research methods and scholarship in psychological, sociological, economic, political, historical, and philosophical studies of education.
Prerequisites, study in a discipline and permission of instructor.

520. PERFORMANCE CURRICULUM IN HUMAN RELATIONS FOR THE ELEMENTARY TEACHER.

To provide prospective elementary teachers with several basic human relations skills. Exercises in attention, flexibility, and decision-making in human relations. Individualized instruction with use of videotape materials and programmed texts.
One classroom hour, four laboratory hours per week.

521. EFFECTIVE CLASSROOM COMMUNICATION: "STRENGTH TRAINING."

A way of working with teacher, counselor, and administrator performance through simulation and videotape feedback. Stress on what kind of school the personnel project to their students. School personnel (pre- and in-service) are taught to evaluate the responses, feelings, and perceptions of students. A laboratory course with assigned readings, meeting once a week for three hours.
Prerequisite, student teaching.

522. THE EDUCATION OF THE SELF.

Educational strategies for increasing self-knowledge. A laboratory approach trains the student in those processes, concepts, and skills leading toward self-observation, pattern clarification, and the development of personal designs for response-experimentation are pursued. Journals and final papers document experiences.
Prerequisite, permission of instructor.

525. EDUCATION IN AFRICA.

Major trends in education on the developing African continent. Emphasis on the changes since independence. The impact of cross-cultural forces at work in education.

526. CURRICULUM DEVELOPMENT IN INTERNATIONAL EDUCATION.

The resources and concepts of curriculum development in international education. Students expected to develop units that can be taught in elementary or secondary schools.

527. CURRICULUM DEVELOPMENTS IN MUSIC AND SOUND IN EDUCATION.

A survey of methods, materials, techniques, and problems related to the innovative use of music and sound in the classroom as an aesthetic medium for enhancing learning of all kinds. Development of experimental innovations and their applications.

528. LABORATORY COURSE IN CROSS-CULTURAL STUDIES.

To develop a sensitivity to cultural differences by examining the elements of cross-cultural communication in an educational context. Primarily for teachers and those working in other educational fields. Experientially based (employing field work, role-playing, and gaming), and balanced by analytical readings, discussions, and

independent study. Fulfills "Foundations" requirement for students seeking Teacher Certification.

529. INTERNATIONAL EDUCATION.

An introduction to certain portions of international education. The issues surrounding education as a tool of development, education in a cross-cultural context, and education through international exchange of persons and ideas. Substantial foreign-student participation. Readings, class discussions, learning games, and individual study projects. Fulfills "Foundations" requirement for students seeking Teacher Certification.

530. CURRICULUM INNOVATIONS IN MOVEMENT AND DANCE IN EDUCATION.

A survey of methods, materials, techniques, problems, and relevant research literature related to the use of movement and dance in the classroom as an aesthetic medium for enhancing learning of all kinds. Experimental application of innovations developed in the course.

531. ISSUES OF FREEDOM AND RESTRAINT IN ACADEMIC POLICY.

The sociological, philosophical, economic, and anthropological considerations found in freedom and restraint conflict, via readings in periodicals and discussions.

534. DEVELOPMENT OF LEADERSHIP IN EDUCATIONAL INNOVATION.

A strong adviser-student relationship is used to create an individualized program from the wide range of learning experiences and sources available. A program description is available on request.

535. EDUCATIONAL MEDIA, TECHNOLOGY, AND SYSTEMS.

The characteristics, capabilities, applications, and implications of a variety of media to a variety of educational strategies. An introductory survey course for media specialists, and a basic course in modern communications media and techniques for other educators. Presentations, laboratory, and project.

536. AUDIOVISUAL INFORMATION TRANSMISSION.

Available knowledge and technology useful in the design of audiovisual materials. A search for principles useful in planning materials to aid in cognitive and effective experiences in educational contexts.

537. MEDIA PRODUCTION SURVEY.

Students prepare slides, graphics, recordings, and still and motion pictures for use in an educational program. Designed for teachers, trainees, and specialists.

541. EDUCATIONAL FILM PRODUCTION.

Theoretical data and project applications: students produce educational messages in a motion picture film format through the use of portable video tape. Two 2-hour lectures per week.

542. CONTEMPORARY EDUCATIONAL PHILOSOPHIES.

Critical examination of selected contemporary philosophies of education. Special attention to social implications and to relevance to educational practice. Fulfills the "Foundations" requirement for students seeking Teacher Certification.

550. CONCEPTIONS OF LIBERAL EDUCATION.

Traditional and modern conceptions of liberal education analyzed with regard to their relevance to contemporary societies and education.

551. FOUNDATIONS OF EDUCATION.

Selected problems and issues in modern education studied through the discipline of educational sociology,

educational history, educational philosophy, comparative education, or social psychology. Independent study or field experience optional. Possible foci are educational aims, societal expectations of the schools, church-state relations, professionalism, academic freedom, curriculum and methodological emphasis, urban education, and educational innovation. Fulfills "Foundations" requirement for students seeking Teacher Certification.

553. EDUCATIONAL TESTS AND MEASUREMENTS.

The most serviceable tests for measuring achievement. Test construction, administration, scoring, and interpretation of results studied and applied to the classroom.

554. EDUCATIONAL ANTHROPOLOGY.

Relevant concepts from cultural anthropology (such as change, human behavior and interaction, and cultural determinants within American culture) applied to education. The culture of the schools and the role of this subculture in the culture as a whole.

557. INTRODUCTION TO URBAN EDUCATION.

Discussion groups survey urban and suburban schools, discuss the process of learning in urban classrooms, study the effects of the present curriculum, and survey various innovative techniques as they apply to urban schools.

558. BLACK AND AFRICAN STUDIES CURRICULUM FOR PUBLIC SCHOOLS.

Four class hours weekly plus assigned demonstrations and observations of certain Black cultural centers and other ethnic settings and situations.

559. PRINCIPLES AND METHODS OF TEACHING ELEMENTARY SOCIAL STUDIES.

Students evaluate various state, commercial, and project social-studies curricula in terms of instructional strategies. Practical experience in creating a social studies unit.

560. THE ELEMENTARY SCHOOL CURRICULUM.

The content and methodology of the elementary school curriculum. Emphasis on the unit method and activity programs.

Prerequisites, electives in Foundations of Education and Child Psychology, Educational Psychology, or Human Development.

561. PRINCIPLES AND METHODS OF TEACHING READING AND LANGUAGE ARTS IN THE ELEMENTARY SCHOOLS.

Approaches to the teaching of reading and language arts in the elementary schools. Innovations in methods and materials demonstrated and discussed.

562. PRINCIPLES AND METHODS OF TEACHING ELEMENTARY SCIENCE.

Provides aid in preparing pre-service students for teaching science in elementary schools. Methods, materials, and latest curriculum work.

563. PRINCIPLES AND METHODS OF TEACHING ELEMENTARY MATHEMATICS.

An introduction to the structure of mathematics, and to the role, methods, material, and curricular aspects of mathematics education in the school.

564. PRINCIPLES OF ELEMENTARY EDUCATION.

Aim, organization, program, and pupil population of the elementary school, and the relationship between elementary and secondary school education.

565. EDUCATING THE DISADVANTAGED CHILD.

The issues and problems in educating disadvantaged

children. Emphasis on urban elementary education; rural education problems also addressed.

567. URBAN COMMUNITY RELATIONS.

The relationships between urban communities and the programs, agencies, and institutions that serve them. On-site field experiences involving various community organizations.

568. CURRICULUM DEVELOPMENT IN URBAN EDUCATION.

Students develop new and innovative curricula for urban schools and investigate what kinds of curriculum development are relevant to inner-city environments. A post-urban internship consisting of lectures, seminars, and field experience.

572. TEACHING READING TO SPECIAL POPULATIONS.

Approaches to the teaching of reading to such special populations as the disadvantaged, the gifted, and the emotionally disturbed, with stress on the individualized and experience approaches. One group studied intensively.

574. READING CLINIC.

Students assume supervised assignments in the roles for which they are preparing (for example, clinician, director or instructor) in the School of Education Reading Clinic and in special schools in the area.

575. DIAGNOSIS OF READING DISABILITIES.

Identification and diagnosis of reading disabilities and analysis of case studies. Each student participates in interviews and individual diagnosis, and writes a case study. Evaluation techniques and current theories of diagnostic procedures discussed. Required for certification in most states.

576. DEVELOPMENTAL READING AT THE HIGH SCHOOL, COLLEGE, AND ADULT LEVELS.

Evaluation of trends, techniques, programs, and materials in teaching developmental reading and study skills. Work in the college reading-study program with individuals and groups. Preparation for reading certification at high school and adult levels.

577. PRINCIPLES OF SCHOOL GUIDANCE.

The nature of guidance and its need in the schools with an overview of an adequate guidance service for a school system.

582. PRE-PRACTICUM IN EDUCATION.

Practicum experience in teaching prior to Student Teaching. Includes such experiences as microteaching, "strength training," and tutoring. Required for students seeking Teacher Certification.

584. ORGANIZATION AND ADMINISTRATION OF A DISTRIBUTIVE EDUCATION PROGRAM.

Activities necessary to initiate, maintain, and improve a Distributive Education Program. Focus on organization and administration at the secondary level.

585. OBSERVATION AND PRACTICE TEACHING.

A 16-week field experience under the tutelage of a cooperating teacher and University supervisor in an approved school system. No graduate credit given for students majoring in Education except for M.A.T. candidates.

Prerequisite, Educ 582.

Credit, 6-12.

586. COORDINATION TECHNIQUES FOR COOPERATIVE PROGRAMS.

Coordination principles, techniques, and supervisory practices of a distributive education coordinator. Inte-

grated classroom instruction and field work under the supervision of a cooperating teacher.

587. VOCATIONAL ADULT EDUCATION.

Organization and administration of vocational adult classes; the interrelationships between secondary and adult education.

588. DIRECTED OCCUPATIONAL EXPERIENCES (EXTERNSHIP PROGRAM).

Eight weeks of directed occupational experience in each of the three major fields of distribution (retail, wholesale, service) planned individually by student, cooperating business, and vocational-technical education staff prior to enrolling.

589. METHODS AND MATERIALS FOR DISTRIBUTIVE EDUCATION.

Information on securing, evaluating, organizing, and presenting instructional materials and experiences. Designed for prospective distributive-education personnel.

590. OBSERVATIONAL TECHNIQUES IN EARLY CHILDHOOD EDUCATION.

Observation of early childhood educational programs of various kinds serving disadvantaged as well as middle-class children.

Four laboratory hours per week during the first four weeks of the first semester.

Credit, 1.

591. EARLY CHILDHOOD EDUCATION MOVEMENT.

Contemporary purposes, programs, and problems of early childhood education, from an historical and philosophical perspective. A one-semester graduate seminar. Meets state requirements for Teacher Certification.

592. SEMINAR IN CURRICULUM DEVELOPMENT FOR EARLY CHILDHOOD EDUCATION.

Curriculum components for children in early-education programs designed to follow each field-teaching experience. Limited to students specializing in early childhood education.

593 (I), 594 (II). LABORATORY COURSE IN USING HUMAN DEVELOPMENT KNOWLEDGE IN EDUCATION.

A year-long laboratory course paralleling both field-teaching experiences for students concentrating on early childhood education. Factors such as sex, environment, social status, and culture examined in terms of their relation to growth rates and patterns. Data taken from the community in which each teaching experience takes place.

598. THE INDIVIDUAL AND THE ORGANIZATION OF HIGHER EDUCATION.

Analysis of the effects of institutional and organizational structure and values on individual development.

599. ALTERNATIVE STRUCTURES IN HIGHER EDUCATION.

Review and analysis of organizational structures of institutions of higher education; design of alternative models for governance and learning.

609. PRINCIPLES AND METHODS OF TEACHING SECONDARY ENGLISH.

An analysis of purposes, problems, issues, methods, and materials in the teaching of English at the secondary level. Discussion, lectures, case studies, projects.

Prerequisite for student teaching in English.

610. PRINCIPLES AND METHODS OF TEACHING SECONDARY SOCIAL SCIENCES.

A critical examination of various possible goals and strategies for secondary-school social-studies instruction, to help the prospective teacher develop a defensible

rationale for his teaching. Designed as a pre-service offering.

611. PRINCIPLES AND METHODS IN TEACHING SECONDARY MATHEMATICS.

The nature and content of mathematics, learning strategies, and values of self and society; to help the pre-service mathematics teacher formulate his own philosophy and rationale for education in mathematics.

612. PRINCIPLES AND METHODS IN TEACHING SECONDARY SCIENCE.

The nature and content of science, learning strategies, and values of self and society, to help the pre-service science teacher formulate his own philosophy and rationale for education in science.

616. AMERICAN SECONDARY EDUCATION.

Learning materials and activities and their organization in various teaching fields.

Prerequisite, an elective in Foundations of Education and Psych 793. *Credit, 2.*

619. EDUCATION AND PUBLIC POLICY.

Selected issues and problems concerning the interaction between education and politics at the local, state, and national levels.

620. INTRODUCTION TO COMPENSATORY EDUCATION.

The ways in which various cultures differentially prepare students for successful performance in public school; translating this into curriculum development, appropriate teaching techniques, and sound educational procedures. A cross-section of current compensatory programs examined and discussed.

621. PROBLEMS IN RURAL EDUCATION.

Problems peculiar to students living in rural areas and educational systems and to teachers serving rural areas. Ways to compensate for the lack of various kinds of technological supports available in urban areas; practical means of guaranteeing adequate levels of sophistication in curriculum content and basic educational experiences. May be taken with or without the practicum which involves the application and evaluation of principles in field work.

622. READINGS IN EVALUATION IN COMPENSATORY EDUCATION.

The assessment of needs, identification of resources, specification of program objectives in behavioral terms, staffing requirements and techniques, and proposal writing. Review of many different proposals for compensatory education programs, and site visits to several area programs.

624. DESIGN AND MANAGEMENT OF SCHOOL INFORMATION SYSTEMS.

Systems analysis, problem definition, hardware selection, site preparation, systems design, staff selection, information collection and display, programming and procedure documentation standards, and user-training for various types of information systems. Concurrent internship in an appropriate school information center expected. Prerequisite, a knowledge of computer programming.

630. ECONOMICS OF EDUCATION.

An introduction to economists' approaches to education as an investment in human capital. Review of the literature. Topics such as cost-benefit ratios for individuals and society, manpower forecasts, and resource allocation for invention and new knowledge. Changing requirements for American education from an economic perspective for urban schools, on-the-job training, informal schooling, etc.

632. INTRODUCTION TO MEASUREMENT AND EVALUATION.

Basic principles of measurement. Topics include descriptive statistics, reliability, validity, principles of test-construction, item analysis and a review of standardized tests.

655 (I), 656 (II). INTRODUCTION TO STATISTICS AND COMPUTER ANALYSIS IN EDUCATION.

Methods for reducing masses of data to a few convenient descriptive terms, and drawing inferences from them. First semester includes elementary descriptive statistics, control of the computer terminal (use of packaged programs), and the beginning of inferential statistics. Second semester includes inferential statistics, some programming concepts with a computer language (FORTRAN) for unique solutions of problems. Two lectures and two laboratory sessions each week. First semester (or consent of instructor) prerequisite for second semester.

657. TEACHING THE HANDICAPPED THROUGH MEDIA.

Professional preparation in educational media and technology. Partially fulfills requirements for the educational media and technology program.

658 (I), 659 (II). INTRODUCTION TO SCHOOL ADMINISTRATION.

To introduce each of the many disciplines on which an administrator calls. Members of the faculty of the University and the Five Colleges lecture on their own disciplines.

660. EDUCATIONAL BROADCASTING.

A history of educational broadcasting. The current status, development, and availability of radio and television programming for educational purposes. Evaluation of radio and television in accordance with instructional objectives.

661. SCIENCE EDUCATION IN THE ELEMENTARY SCHOOLS.

For teachers or other interested persons who wish to bring their knowledge of methods, materials, and curriculum up to date. Laboratory approach.

662. EDUCATIONAL TV WORKSHOP.

For teachers and teacher interns. The hardware of television; experimental use of television in solving educational problems.

663. EDUCATION IN ASIA.

The relationship between education and society in the major nations of the Far East. The process of change in educational thought and institutions; the conflict between tradition and contemporary forces.

664. ANALYSIS AND INTEGRATION OF CULTURAL EXPERIENCES.

Integration and analysis of cross-cultural learning experiences. Students who have lived abroad examine their experiences through directed readings, seminar discussions, and independent study.

665. EDUCATION IN LATIN AMERICA.

The developmental history of the educational structures and systems of Latin America. Emphasis on the effectiveness of the various educational models. Analysis based on related case studies.

666. EDUCATION AND DEVELOPMENT.

The relationship between the development of national and regional areas and education. Systems analysis introduced; areas for potential research projects identified.

667. PREPARATION AND USE OF AUDIO-VISUAL MATERIALS. Machines, materials, and techniques for teaching groups of students.

669. PRACTICUM IN INTERNATIONAL EDUCATION. Supervised practical experience in various areas of international education.

672. PRINCIPLES AND PRACTICES IN VOCATIONAL EDUCATION. Emphasis on secondary and post-secondary programs and the relationship of vocational education to the total educational program.

673. APPRENTICE TEACHING IN AGRICULTURE. A full year (in absentia) teaching agriculture, horticulture, and related subjects under a supervising teacher in a selected school. *Credit, 6.*

675. METHODOLOGY AND MATERIALS ON TEACHING IN OCCUPATIONAL EDUCATION. A seminar approach to special methodology in occupational education. Content based on experiences of students in teaching. Laboratory section in microteaching.

676. PREPROFESSIONAL LABORATORY EXPERIENCE IN OCCUPATIONAL EDUCATION. Participatory experience in teaching in occupational education programs, including directed observation of instructional activities, teaching individuals and conducting occupational placement, and/or off-farm instruction.

678. PRACTICUM IN HUMANISTIC CURRICULUM DEVELOPMENT. Models for the development of humanistic curricula. Students will employ one or more models in writing their own curricula, and evaluate their efforts in light of existing curricula in the field. Prerequisites, Educ 522 and permission of instructor.

685. PRACTICUM IN EDUCATION. Each semester a group of experimental courses will be offered dealing with practical experiences in some phases of education. *Credit, 1-6.*

686. SPECIAL PROBLEMS IN EDUCATION. A group of experimental courses offered each semester.

689. INTERNSHIP IN INTERNATIONAL EDUCATION. Internships for selected students in various public and private institutions concerned with international education. *Credit, 1-6.*

Electrical Engineering

GRADUATE FACULTY

LESTER C. VAN ATTA, *Acting Chairman of the Department of Electrical Engineering and Professor*, B.S., Reed College, 1927; Ph.D., Washington University, 1931.

MICHAEL A. ARBIB, *Professor and Head of Computer and Information Science*.

GILBERT W. BETT, *Associate Professor*, B.S., Massachusetts Institute of Technology, 1952; M.S., 1952, E.E., 1958.

LEONARD S. BOBROW, *Assistant Professor*, B.S., University of Miami, 1962; M.S., Northwestern University, 1964; Ph.D., 1968.

ROGER W. EHRLICH, *Assistant Professor*, B.S., University of Rochester, 1965; M.S., Northwestern University, 1967; Ph.D., 1969.

CAXTON C. FOSTER, *Professor of Computer Science*. LEWIS E. FRANKS, *Professor*, B.S., Oregon State University, 1952; M.S., Stanford, 1953; Ph.D., 1957.

ROBERT M. GLORIOSO, *Associate Professor*, B.S., Northeastern, 1962; M.S., Connecticut, 1964; Ph.D., 1967.

HERBERT A. HERCHENREDER, *Assistant Professor*, B.S., University of Missouri, 1951; M.S., Connecticut, 1957.

FRANCIS S. HILL, JR., *Assistant Professor*, B.E., Yale, 1962; M.E., 1964; Ph.D., 1968.

CHARLES E. HUTCHINSON, *Professor*, B.S., Illinois Institute of Technology, 1957; M.S., Stanford, 1961; Ph.D., 1963.

DARRELL R. JACKSON, *Associate Professor*, B.S., University of Washington, 1960; M.S., 1963; Ph.D., 1966.

IMSONG LEE, *Professor*, B.E.E., Rensselaer Polytechnic Institute, 1957; M.E.E., Polytechnic Institute of Brooklyn, 1959; Ph.D., Stanford, 1962.

ROBERT E. MCINTOSH, *Associate Professor*, B.S., Worcester Polytechnic Institute, 1962; M.S., Harvard, 1963; Ph.D., University of Iowa, 1967.

JOHN W. MOHN, *Associate Professor*, M.E., Stevens Institute of Technology, 1941; B.S., Worcester Polytechnic Institute, 1947; M.S., Stanford, 1952.

RICHARD V. MONOPOLI, *Professor*, B.S., U.S. Naval Academy, 1952; M.S., Brown, 1960; Ph.D., Connecticut, 1965.

DAVID H. NAVON, *Professor*, B.E.E., City College of New York, 1947; M.S., New York University, 1950; Ph.D., Purdue, 1953.

EDWARD M. RISEMAN, *Assistant Professor of Computer Science*.

DONALD E. SCOTT, *Associate Professor*, B.S., Connecticut, 1957; M.S., 1959; Ph.D., Worcester Polytechnic Institute, 1968.

G. DALE SHECKELS, *Professor*, B.S., University of Washington, 1938; M.S., Massachusetts Institute of Technology, 1940; Ph.D., Iowa State University, 1955.

TING-WEI TANG, *Associate Professor*, B.S., National Taiwan University, 1957; M.S., Brown, 1961; Ph.D., 1964.

IAN B. THOMAS, *Associate Professor*, B.E. (Elec.), University of Queensland, 1958; B.S. (Phys.), 1959, M.S., University of Illinois, 1961; Ph.D., 1966.

CONRAD A. WOGGIN, *Professor of Computer Science*. SIGFRID YNGVESSON, *Associate Professor*, Teknologic Licentiat, Chalmers Institute of Technology, Sweden, 1964; Teknologic Doktor, 1968.

THE DOCTOR OF PHILOSOPHY DEGREE PROGRAM

In addition to the residency, dissertation, and examination requirements described in the General Information section of this bulletin, the following departmental requirements must be satisfied:

There is no formal course requirement for the Ph.D. degree. Typical programs include approximately 24 credits of course work beyond the course requirements for the master's degree.

All doctoral students are required to pass a qualifying examination. This examination is administered every January, and all students are encouraged to take this examination in their first year of graduate study.

A written foreign language examination, normally in French, Russian, or German, is required of each candidate to determine whether he has a reading knowledge of a foreign language sufficient to understand technical-journal material. This examination is administered by the Electrical Engineering Department.

A brochure containing detailed information on the Ph.D. degree in Electrical Engineering is available from the Departmental Graduate Committee.

THE MASTER OF SCIENCE DEGREE PROGRAM

Required are:

1. EE 800, Thesis, 6 credits.
2. At least four EE 700-series courses.
3. Additional graduate courses chosen by the student with the approval of his adviser, to constitute a unified program and to satisfy the 30-credit requirement for the M.S. degree. These courses are normally chosen from the fields of engineering, mathematics, physics, and computer science.
4. Supporting courses as required to remove background deficiencies.
5. University-wide requirements as described in the General Information section of this bulletin.
6. The student is assigned a temporary program adviser by the Departmental Graduate Committee. The student is encouraged to select a major thesis adviser after one semester of study. In consultation with his major thesis adviser, the student prepares a proposal for thesis research to be submitted for approval to the Departmental Graduate Committee.

A brochure containing detailed information on the requirements for the M.S. degree in Electrical Engineering is available from the Departmental Graduate Committee.

RESEARCH IN ELECTRICAL ENGINEERING

The Electrical Engineering Department is conducting active research and has supporting academic programs in the following areas:

1. Computer Systems Engineering.
2. Communications and Signal Processing.
3. Systems and Control Theory.
4. Man-Machine Systems.
5. Solid State Devices and Microelectronics.
6. Electrodynamics and Plasma Physics.
7. Ocean Engineering.
8. Masers and Lasers.

**ALL COURSES CARRY 3 CREDITS UNLESS
OTHERWISE SPECIFIED**

COURSES OPEN TO GRADUATE STUDENTS ONLY

(For either major or minor credit)

700. SPECIAL PROBLEMS.

Recent advances and current problems in a specialized field of electrical engineering.
Prerequisite, permission of instructor.

702. ALGEBRA AND CODING.

Groups, homomorphisms, kernels, parity check matrices and codes, isomorphism theorems and decoding. Rings, ideals, residue class rings and cyclic codes. Galois fields and BCH codes. Encoding and decoding with shift registers.
Mr. Bobrow.

703. PROBABILITY AND INFORMATION THEORY.

Elementary probability theory including probability density and distribution functions, joint random variables, and the law of large numbers. Information measure and entropy concepts, channel capacity, Shannon's noiseless and noisy coding theorems.
Mr. Bobrow.

704. STATE VARIABLE ANALYSIS.

Matrix analysis, state variables and state space techniques. Concepts of controllability and observability. Stability analysis via Liapunov's and Popov's method, phase plane and describing function.
Mr. Hutchinson, Mr. Monopoli.

705. ANALYSIS OF LINEAR SYSTEMS.

Complex variables, modern systems analysis basic to network synthesis, control systems, and communication systems; including Laplace, Fourier, and z transforms and convolution.
Mr. Bobrow.

706. ELECTROMAGNETIC FIELD THEORY.

Microscopic and macroscopic properties of magnetic and insulating materials; gyromagnetism and the permeability tensor; reflection and refraction; skin effect; antenna analysis; relativistic electrodynamics.
Prerequisite, EE 257 or equivalent.

Mr. McIntosh, Mr. Tang.

707. MODERN SOLID-STATE ENGINEERING.

Fundamental quantum mechanical principles, a basis for advanced courses in semiconductor electronics, microwave magnetics, quantum electronics, etc. Solutions of Schrodinger's equation pertinent for electrical engineers.
Prerequisite, EE 201 or equivalent.

Mr. Navon, Mr. Yngvesson.

708. SIGNAL THEORY I.

Unified treatment of techniques for representation of signals and signal processing operations. Emphasis on physical interpretation of vector spaces, linear operators, transform theory, and optional design of signals.

Mr. Franks, Mr. Hill.

711. ADVANCED MICROWAVE ENGINEERING.

Analysis of waveguides, gyrators, antennas, and other microwave circuit elements; electron ballistics; ionospheric reflection; and refraction, and the permittivity tensor; microwave generators; masers and lasers.
Prerequisites, EE 294 and 706 or equivalent.

Mr. McIntosh, Mr. Yngvesson.

712. INTRODUCTION TO PLASMA DYNAMICS.

Fundamentals of plasma physics: motion of a charged particle in electromagnetic fields, magnetoionic theory, the Boltzmann and Vlasov equations for plasmas, and wave propagation through a plasma medium.
Prerequisite, EE 706.

Mr. McIntosh, Mr. Tang.

713. ADVANCED PLASMA DYNAMICS.

Review of classical kinetic theory. The BBGKY hierarchy and other kinetic equations for plasmas. Applications to waves in cold and hot plasmas, plasma radiations and instabilities.

Prerequisite, EE 712.

Mr. McIntosh, Mr. Tang.

721. MODERN ENGINEERING MAGNETICS.

Paramagnetism, paramagnetic resonance, solid-state masers, ferro- and ferrimagnetism, magnetic domains, Ising model, spin waves, ferromagnetic resonance, mag-

neto-elastic, coupling, instability phenomena, resonance devices, power limiters, microwave ultrasonics in magnetic materials.

Prerequisite, EE 707.

Mr. Jackson.

722. PHYSICAL SEMICONDUCTOR ELECTRONICS. Crystallography of solids, band theory of solids, quantum theory of electrons in a periodic lattice, dynamics of lattice vibrations, semiconductors—equilibrium and transient behavior, modern quantum electronic devices.

Prerequisite, EE 707.

Mr. Navon.

723. PRINCIPLES OF MASERS AND LASERS.

Quantum-mechanical description of typical maser and laser materials, fundamentals of maser amplification, analysis of maser and laser devices, review of applications.

Prerequisite, EE 707.

Mr. Yngvesson.

725. ENERGY STORAGE AND PROCESSING (OE 721).

Methods of energy generation, conversion, and control, with emphasis on the utilization for deep-sea submersible vehicles.

Mr. Monopoli, Mr. Navon, Mr. Sheckels.

733. DIGITAL CONTROL SYSTEMS.

Pulse transfer functions and state transition analysis applied to discrete-data systems. Nonconventional sampling. Nonlinear sampled data systems. Dynamic programming and computer control.

Prerequisite, EE 704.

Mr. Monopoli, Mr. Hutchinson.

734. OPTIMUM CONTROL SYSTEMS.

Analytical design of optimum linear systems. Calculus of variations. Pontryagin's Maximum Principle, and applications to design of optimum systems. Minimum mean square estimation and control.

Prerequisite, EE 704.

Mr. Hutchinson, Mr. Monopoli.

735. ADAPTIVE CONTROL.

The problem of system identification, performance criteria and decision-making, and the implementation of adaptive techniques. Application of adaptive techniques to aircraft flight control.

Prerequisite, EE 733, 734.

Mr. Hutchinson, Mr. Monopoli.

736. DYNAMICS AND CONTROL OF MARINE VEHICLES (OE 752).

The equations of motion for a marine vehicle; the stability and dynamics for control.

Mr. Hutchinson.

741. SIGNAL THEORY II.

Signal Space methods applied to random processes, giving the modern interpretation of optimum filtering, signal parameter estimation, and signal detection. Many examples of practical applications.

Mr. Franks, Mr. Hill.

743. NAVIGATION (OE 751).

A survey of the principles of navigation. Emphasis on the information-processing involved and error analysis.

Mr. Hutchinson.

745. INFORMATION TRANSMISSION SYSTEMS. Practical topics in the design of digital and analog data communication systems. Modulation and coding. Diversity systems and multiplexing of signals. Channel equalization. Information capacity of channels and error-rate performance.

Prerequisite, EE 741.

Mr. Franks, Mr. Hill.

746. STATISTICAL COMMUNICATION THEORY.

Review of probability and random process theory; series expansions of random processes, shot noise; the Gaussian process; optimum smoothing and prediction; random signals through nonlinear devices; introduction to decision theory.

Prerequisite, EE 703.

Mr. Franks, Mr. Hill.

748. NETWORK SYNTHESIS.

Synthesis methods for the realization of passive networks; Brune, Bott-Duffin, Darlington doubly terminated two-ports and others. Positive-real functions, the approximation problem. Chebyshev and Butterworth filters.

Prerequisite, EE 705.

Mr. Bobrow.

750. GRAPH THEORY AND ITS APPLICATIONS.

Fundamental concepts of graph theory including circuits, cut-sets, paths, and duality. Application to network analysis and synthesis, switching theory, variable-length and error-correcting codes, and communication networks.

Mr. Bobrow.

751. SWITCHING AND AUTOMATA THEORY.

Homing and diagnosis of sequential machines, fault detection and diagnosis of combinatorial and sequential networks. State assignment in sequential machines, linear sequential machines, universal modules, and related decision problems.

Prerequisites, EE 510, CS 570, or equivalent.

Mr. Ehrich.

752. OPTIMIZATION THEORY AND PRACTICE.

Mathematical formulation and techniques of optimization problems; constrained extremization of functions of several variables; inequality constraints; geometric and linear programming; the calculus of variations; dynamic programming; search techniques for computers; game theory; specific applications to electrical engineering.

Mr. Hill.

762. INTRODUCTION TO SPEECH ANALYSIS.

The acoustics of speech production and the engineering analysis techniques employed in speech processing.

Mr. Thomas.

763. ADVANCED SPEECH PROCESSING.

Advanced studies of speech-processing techniques with emphasis on current literature in speech analysis, transmission, synthesis, and recognition by machine.

Prerequisite, EE 762.

Mr. Thomas.

764. UNDERWATER ACOUSTICS (OE 701).

The principles, effects, and phenomena of underwater sound and its application to practical problems.

Prerequisite, EE 306, 606.

Mr. Hutchinson, Mr. Thomas, Mr. Russell.

785. SELECTED TOPICS IN CONTROL SYSTEMS.

Topics selected from the current literature. An investigation in depth of problems relating to particular aspects of automatic control theory.

Credit, 1-3.

786. SELECTED TOPICS IN COMMUNICATIONS.

Topics for various aspects of present interest in the field of communications with emphasis on concurrent reading of the literature.

Credit, 1-3.

787. SELECTED TOPICS IN COMPUTER ENGINEERING.

Topics of current interest in computers, automata, and related areas. Specific topics selected from the literature.

Credit, 1-3.

793, 794. SEMINAR IN ELECTRICAL ENGINEERING.

Presentations of current research activities and literature by faculty and graduate students.

Credit, 1 each semester.

800. MASTER'S THESIS.

An individual theoretical and/or experimental investigation or a design problem terminating with an acceptable thesis. The research proposal is to be approved at least five months before graduation.

900. DOCTORAL DISSERTATION.

Credit, 30.

COURSES OPEN TO BOTH GRADUATE AND UNDERGRADUATE STUDENTS
(For either major or minor credit)

510. DIGITAL CIRCUIT THEORY.

An introduction to the theory of digital circuits stressing general techniques for the analysis and synthesis of combinational and sequential logic systems.

Prerequisite, junior standing.

Mr. Glorioso, Mr. Edwards, Mr. Ehrich.

566. SIGNAL PROCESSING AND COMMUNICATION SYSTEMS I.

Principles of design of modern communication systems. Mathematical description of digital and analog signals. Basic limitations of modulation techniques and information capacity of transmission systems.

Prerequisites, EE 202, 204.

Mr. Franks, Mr. Hill.

567. SIGNAL PROCESSING AND COMMUNICATION SYSTEMS II.

Techniques for evaluating performance of modulation and information transmission systems. Extraction of signals from noise. Minimum error signal estimation and detection.

Prerequisites, EE 266, 265 or permission of instructor.

Mr. Franks, Mr. Hill.

570. SOLID STATE DEVICES.

Review of transistor physics, recombination statistics, avalanche and tunneling phenomena, varactor diodes, thyristors, tunnel diodes, junction and MOS field-effect devices, p-n junction lasers.

Prerequisite, EE 201.

Mr. Jackson, Mr. Navon, Mr. Yngvesson.

571. MICROELECTRONICS.

Principles and applications of microelectronics with particular emphasis on silicon monolithic integrated circuits. Fundamental limitations of microminiaturization, design constraints imposed by the monolithic technique, planar technology, digital and linear microcircuits.

Prerequisite, EE 201.

Mr. Navon.

578. DIGITAL SYSTEM DESIGN.

The design of a digital system by the interface of subunits described in terms of register sets. The subunits are interfaced at the architectural level by a set of instructions and at the logic level by the Boolean equations derived from the corresponding register transfers.

Prerequisite, EE 210.

Mr. Edwards, Mr. Ehrich, Mr. Glorioso.

587. MARINE INSTRUMENTATION.

A survey of the oceanographic parameters of interest to ocean engineers; the theory of measurement for those parameters. Typical examples of existing measuring equipment.

Mr. Hutchinson.

590. FEEDBACK CONTROL SYSTEMS I.

Time domain and frequency domain analysis and synthesis techniques for linear continuous control systems. The relationships between these techniques.

Prerequisites, EE 142 or permission of instructor.

Mr. Hutchinson, Mr. Monopoli.

591. FEEDBACK CONTROL SYSTEMS II.

The analysis of nonlinear continuous control systems and an introduction to digital control systems and optimization techniques.

Prerequisite, EE 290.

Mr. Hutchinson, Mr. Monopoli.

594. MICROWAVE ENGINEERING I.

Electromagnetic theory applied to microwave propagation in waveguides and coaxial lines. Microwave circuit theory with applications to passive microwave networks.

Prerequisite, EE 258.

Mr. McIntosh, Mr. Tang, Mr. Yngvesson.

595. MICROWAVE ENGINEERING II.

Continuation of EE 594, modern microwave components including filters, ferrite devices, multiport junctions, amplifiers, and oscillators. Generation, radiation, and detection of microwaves.

Prerequisite, EE 594.

Mr. McIntosh, Mr. Tang, Mr. Yngvesson.

598. BIOMEDICAL ENGINEERING I.

Techniques and concepts from control and communication theory useful in biological, medical, and psychophysical research.

Prerequisite, permission of instructor.

Mr. Scott.

599. BIOMEDICAL ENGINEERING II.

Engineering analysis of the visual, position-motion sensing, taste and smell biological communication channels; human tracking capabilities, analog and hybrid modeling.

Prerequisite, EE 598.

Mr. Scott.

606. ACOUSTICS.

The fundamentals of sound generation, propagation, and detection. Applications of theory to underwater sound and human speech.

Mr. Thomas.

611. APPLIED NONLINEAR ANALYSIS.

The analysis of nonlinear mechanical and electrical systems. Numerical, graphical, and analytical methods used to determine the behavior of modern nonlinear devices.

Prerequisite, Math 174.

Mr. McIntosh.

642. NON-NUMERICAL PROCESSING.

Introduction to basic mathematical and logical concepts relevant to description and manipulation of information structures such as lists, trees, and graphs in LISP.

Prerequisite, CS 233.

Mr. Lee.

644. PROGRAMMING STRUCTURES.

Introduction to basic structures of algorithms and programming languages. Convergence of algorithms. Introduction to logic and programming languages for description and implementation of algorithms.

Prerequisite, CS 223.

Mr. Ehrich, Mr. Lee.

654. COMPUTER SYSTEMS LABORATORY III.

Project laboratory in advanced computer systems engineering including designs of integrated hardware/software systems and studies of current computer techniques.

Nine laboratory hours.

Prerequisite, permission of instructor.

Mr. Glorioso, Mr. Lee.

656. INTRODUCTION TO AUTOMATA THEORY.

An introduction to formal processes of computation. Computability, automata, algorithms, recursive functions. Formal systems, computing power of machines, and automata as examples of formal systems.

Prerequisite, permission of instructor.

Mr. Ehrich.

660. COMPUTER GRAPHICS.

Basic organization of computer-driven graphical display systems. Methods for generation and manipulation of vectors and characters for real-time display. Data structures for picture and text processing.

Prerequisites, CS 233, EE 642.

Mr. Lee.

662. SELF-ORGANIZING SYSTEMS AND PATTERN RECOGNITION.

Several aspects of self-organizing systems and pattern recognition including machine intelligence, adaptation, learning, and self-repair.

Mr. Glorioso.

666. ANALOG AND HYBRID COMPUTERS.

Designed for computer science or engineering students interested in the hybrid computer as a computational tool. Review of analog and digital computers and their combination.

Prerequisite, permission of instructor.

Mr. Bett.

668. ADVANCED SWITCHING THEORY.

Topics of contemporary interest in digital switching theory and logical design. State-of-the-art techniques in computer hardware design.

Prerequisite, EE 510.

Mr. Ehrich, Mr. Glorioso.

English

GRADUATE FACULTY

JOSEPH FRANK, *Head of the Department of English and Professor*, B.A., Harvard, 1939; M.A., 1947; Ph.D., 1953.

RICHARD NOLAND, *Director of Graduate Studies in English and Associate Professor*, B.A., Emory, 1954; M.D., 1958; M.A., Columbia, 1961; Ph.D., 1968.

TAMAS ACZEL, *Associate Professor*, B.A., University of Budapest, 1948; M.A., 1950.

GARY L. AHO, *Assistant Professor*, B.A., Portland State College, 1959; Ph.D., University of Oregon, 1966.

JEREMIAH ALLEN, *Dean of Humanities and Fine Arts and Professor*, B.A., Duke University, 1947; M.A., Tufts University, 1948; Ph.D., University of Colorado, 1956.

RUSSELL K. ALSPACH, *Professor Emeritus and Part-time Lecturer*, B.A., University of Pennsylvania, 1924; M.A., 1931; Ph.D., 1932.

THOMAS W. ASHTON, *Assistant Professor*, B.A., City College of New York, 1963; M.A., Columbia, 1964; Ph.D., Columbia, 1969.

ROBERT E. BAGG, *Associate Professor*, B.A., Amherst College, 1957; M.A., University of Connecticut, 1961; Ph.D., 1965.

ELLSWORTH BARNARD, *Professor*, B.S., University of Massachusetts, 1928; M.A., University of Minnesota, 1929; Ph.D., 1935.

BERNARD BELL, *Assistant Professor*, B.A., Howard University, 1962; M.A., 1966; Ph.D., University of Massachusetts, 1970.

NORMAND BERLIN, *Associate Professor*, B.A., New York University, 1953; M.A., Columbia, 1956; Ph.D., California at Berkeley, 1964.

HOWARD O. BROGAN, *Commonwealth Professor*, B.A., Grinnell College, 1936; M.A., State University of Iowa, 1938; Ph.D., Yale, 1941.

MARIE CAMPBELL, *Professor*, B.A., Southern Illinois, 1932; M.A., George Peabody College, 1937; Ph.D., Indiana, 1956.

GEORGE CAREY, *Associate Professor*, B.A., Middlebury College, 1958; M.A., Indiana University, 1962; Ph.D., 1966.

JULES CHAMETZKY, *Professor*, B.A., Brooklyn College, 1950; M.A., Minnesota, 1952; Ph.D., 1958.

DONALD S. CHENEY, *Associate Professor*, B.A., Yale, 1954; M.A., 1957; Ph.D., 1961.

DAVID R. CLARK, *Professor*, B.A., Wesleyan University, 1947; M.A., Yale, 1950; Ph.D., 1961.

JOHN CLAYTON, *Associate Professor*, B.A., Columbia College, 1956; M.A., New York University, 1959; Ph.D., Indiana University, 1966.

THOMAS W. COPELAND, *Commonwealth Professor*, B.A., Yale, 1928; Ph.D., 1933.

ROBERT P. CREED, *Professor*, B.A., Swarthmore College, 1948; M.A., Harvard, 1949; Ph.D., 1956.

ARLYN DIAMOND, *Assistant Professor*, B.A., University of California, 1961; Columbia University, 1962; Ph.D., University of California at Berkeley, 1970.

JOSEPH W. DONOHUE, JR., *Associate Professor*, B.A., Johns Hopkins University; M.A., Georgetown University, 1961; Ph.D., Princeton University, 1965.

AUDREY R. DUCKERT, *Professor*, B.A., Wisconsin, 1948; M.A., 1949; Ph.D., Radcliffe College, 1959.

LEE R. EDWARDS, *Assistant Professor*, B.A., Swarthmore College, 1962; M.A., University of California, Berkeley, 1965; Ph.D., 1969.

EVERETT H. EMERSON, *Professor*, B.A., Harvard, 1948; M.A., Duke, 1949; Ph.D., Louisiana State, 1955.

BARNEY D. EMMART, *Chairman, Journalistic Studies Committee and Assistant Professor*, B.A., Harvard, 1947; Ph.D., University of London, 1951.

ANDREW FETLER, *Associate Professor*, B.S., Loyola, 1959; M.F.A., State University of Iowa, 1964.

JAMES A. FREEMAN, *Assistant Professor*, B.A., Amherst College, 1956; Ph.D., University of Minnesota, 1968.

ROBERTS W. FRENCH, *Associate Professor*, B.A., Dartmouth College; M.A., Yale, 1959; Ph.D., Brown University, 1964.

ERNEST GALLO, *Associate Professor*, B.A., St. John's University, 1954; M.A., New York University, 1957; Ph.D., 1965.

WALKER GIBSON, *Professor*, B.A., Yale, 1940; M.A., University of Iowa, 1946.

MORRIS GOLDEN, *Professor*, B.A., City College of New York, 1948; M.A., New York University, 1949; Ph.D., 1953.

RICHARD HAVEN, *Professor*, B.A., Harvard, 1948; M.A., Princeton, 1952; Ph.D., 1958.

VERNON P. HELMING, *Professor*, B.A., Carleton, 1925; Ph.D., Yale, 1937.

JOHN H. HICKS, *Professor*, B.A., Middlebury, 1941; M.A., Boston University, 1952; Ph.D., 1961.

PRISCILLA G. HICKS, *Assistant Professor*, B.A., Wellesley, 1948; M.A., University of Michigan, 1949; Ph.D., Boston University, 1960.

ERNEST H. HOFER, *Associate Professor*, B.A., Brown, 1945; M.A., 1947; Ph.D., Cornell, 1959.

FLORIANA T. HOGAN, *Associate Professor*, B.S., Boston University, 1940; M.A., 1941; Ph.D., 1955.

BETTY A. HUNT, *Assistant Professor*, B.A., University of Georgia, 1950; M.A., Indiana University, 1953; Ph.D., Shakespeare Institute of the University of Birmingham, England, 1964.

EDWARD JAYNE, *Assistant Professor*, B.A., University of California at Berkeley, 1957; M.A., 1962; Ph.D., State University of New York at Buffalo, 1970.

JACK J. JORGENSEN, *Assistant Professor*, B.A., Carleton College, 1965; M.A., City College of New York, 1967; Ph.D., New York University, 1970.

DONALD JUNKINS, *Associate Professor*, B.A., University of Massachusetts, 1953; S.T.B., Boston University, 1955; S.T.M., 1957; M.A., 1959; Ph.D., 1963.

SIDNEY KAPLAN, *Professor*, B.A., College of the City of New York, 1942; M.A., Boston University, 1948; Ph.D., Harvard, 1960.

ARTHUR KINNEY, *Associate Professor*, B.A., Syracuse, 1955; M.S., Columbia, 1956; Ph.D., University of Michigan, 1963.

G. STANLEY KOEHLER, *Professor*, B.A., Princeton, 1936; M.A., Harvard, 1937; M.A., Princeton, 1938; Ph.D., 1942.

JOSEPH LANGLAND, *Professor*, B.A., State University of Iowa, 1940; M.A., 1941.

SIMON O. LESSER, *Professor*, Ph.B., Chicago, 1929.

MASON I. LOWANCE, JR., *Associate Professor*, B.A., Princeton University, 1960; B.A., Oxford University, 1964; M.A., 1966; Ph.D., Emory University, 1967.

PAUL L. MARIANI, *Associate Professor*, B.A., Manhattan College, 1962; M.A., Colgate University, 1964; Ph.D., City University of New York, 1967.

MILTON MAYER, *Professor*.

HAROLD MCCARTHY, *Professor*, B.A., Massachusetts, 1941; M.A., Harvard, 1942; Ph.D., 1950.

JOHN H. MITCHELL, *Professor*, B.S., Bowdoin, 1943; M.A., Harvard, 1947.

ARTHUR B. MUSGRAVE, *Director of Fellowship Program for Journalists and Professor*, B.S., Boston University, 1951; M.S., 1951; Ph.D., Minnesota, 1961.

JOHN R. NELSON, JR., *Assistant Professor*, B.A., Hamilton College, 1959; M.A., University of Maine, 1962; Ph.D., University of Oregon, 1967.

JAY NEUGEBOREN, *Assistant Professor*, B.A., Columbia College, 1959; M.A., Indiana University, 1963.

WILLIAM G. O'DONNELL, *Professor*, B.S., Massachusetts, 1938; M.A., Yale, 1940; Ph.D., 1942.

ALEX PAGE, *Professor*, B.A., Vermont, 1948; M.A., Harvard, 1949; Ph.D., 1953.

DAVID H. PAROISSIEN, *Assistant Professor*, B.A., University of Hull, England, 1961; M.A., New Mexico Highlands University, 1965; Ph.D., University of California, Los Angeles, 1968.

ARTHUR W. PLUMSTEAD, *Professor*, B.A., Western Ontario, 1955; M.A., Rochester, 1957; Ph.D., 1965.

DARIO POLITELLA, *Associate Professor*, B.A., Massachusetts, 1947; M.A., Syracuse, 1949; Ph.D., 1965.

DAVID T. PORTER, *Professor*, B.A., Hamilton, 1950; Ph.D., Rochester, 1963.

MEREDITH B. RAYMOND, *Associate Professor*, B.S., Bridgewater State College, 1939; M.A., Middlebury College, 1943; Ph.D., Boston University, 1964.

JAMES D. REED, *Assistant Professor*, B.A., Michigan State University; M.F.A., University of Montana, 1970.

SEYMOUR RUDIN, *Professor*, B.A., City College of New York, 1941; M.S., 1943; Ph.D., Cornell, 1953.

PAUL F. SAAGPAKK, *Associate Professor*, Ph.D., Columbia, 1966.

JACK SHADOIAN, *Assistant Professor*, B.A., City College of New York, 1963; M.A., University of Connecticut, 1965; Ph.D., 1967.

ARNOLD J. SILVER, *Associate Professor*, B.A., New York University, 1947; M.A., Columbia, 1948; Ph.D., 1958.

JOHN E. SITTER, *Assistant Professor*, B.A., Harvard College, 1966; Ph.D., University of Minnesota, 1969.

BERNARD SPIVACK, *Professor*, B.A., Alabama, 1931; M.A., Harvard, 1932; Ph.D., Columbia, 1950.

CHARLOTTE K. SPIVACK, *Professor*, B.A., New York State University at Albany, 1947; M.A., Cornell, 1948; Ph.D., University of Missouri, 1954.

HARVEY SWADOS, *Professor*, B.A., University of Michigan, 1940.

KATHLEEN M. SWAIM, *Assistant Professor*, B.A., Gettysburg College, M.A., Penn State University, 1958; M.A., Middlebury College, 1963; Ph.D., University of Pennsylvania, 1966.

JAMES TATE, *Assistant Professor*, B.A., Kansas State College of Pittsburg, 1965; M.F.A., University of Iowa, 1967.

ROBERT G. TUCKER, *Associate Professor*, B.A., Amherst, 1949; M.A., Harvard, 1951; Ph.D., State University of Iowa, 1961.

FREDERICK W. TURNER, III, *Associate Professor*, B.A., Denison, 1959; M.A., Ohio State, 1961; Ph.D., Pennsylvania, 1965.

H. LELAND VARLEY, *Professor*, B.A., Wesleyan, 1934; M.A., 1935; Ph.D., Wisconsin, 1952.

JOHN C. WESTON, JR., *Professor*, M.A., Chicago, 1950; Ph.D., North Carolina, 1956.

CYNTHIA WOLFF, *Assistant Professor*, B.A., Radcliffe, 1958; Ph.D., Harvard University, 1965.

MICHAEL WOLFF, *Professor*, B.A., Cambridge, 1948; M.A., St. John's College, 1955; Ph.D., Princeton University, 1958.

Ph.D. FOREIGN LANGUAGE REQUIREMENTS

The Department requires proficiency in one foreign language to be demonstrated by successful completion of two graduate courses in comparative literature; or by successfully completing one graduate-level course in the area of the language chosen; or proficiency in two foreign languages, to be demonstrated by passing the standard foreign-language examinations. Transfer students must fulfill this requirement according to these standards, unless they have been certified as to language proficiency before arrival; others may have partially fulfilled the requirement while earning the master's degree.

All graduate students should secure from the Department of English detailed information on requirements for the degrees.

ALL COURSES CARRY 3 CREDITS UNLESS OTHERWISE SPECIFIED

COURSES OPEN TO GRADUATE STUDENTS ONLY

700. SPECIAL PROBLEMS.

For students wishing to do special work not covered by other courses. Permission of the Director of Graduate Studies and the instructor required. The instructor supervises and evaluates the work. *Credit*, 3-12.

701. HISTORY OF THE ENGLISH LANGUAGE.

Development of the English language. Continuing as well as accomplished changes and variations in sounds, forms, and usage. Survey of dictionaries and grammar in context of teaching. Ms. Duckert.

702. OLD ENGLISH.

Introduction to Old English.

Mr. Creed, Ms. Duckert, Mr. Aho.

- 703. MIDDLE ENGLISH.**
The language and documents representing the chief dialects. Mr. Helming.
- 705. OLD ENGLISH LITERATURE.**
Reading of various Old English works, stressing Beowulf. Prerequisite, English 702, or equivalent.
Mr. Creed, Ms. Duckert.
- 706. MIDDLE ENGLISH LITERATURE.**
Representative poems, verse plays, and selected prose, exclusive of Chaucer.
Prerequisite, English 703 or equivalent.
Mr. Helming, Ms. Diamond.
- 708. CHAUCER.**
Chaucer's *Canterbury Tales* and the critical problems implicit in his works. Mr. Gallo.
- 709. THE WORKS OF CHAUCER'S FRENCH AND ITALIAN PERIODS.**
The complaints, the dream-visions, the later short poems, Boethius, and Troilus as combinations of medieval art and thought with pre-Renaissance motifs. Mr. Gallo.
- 710. HISTORICAL STUDIES IN THE LANGUAGE OF LITERATURE.**
The linguistic milieu in which monuments of British and American literature were created. Emphasis on matters critical to accurate reading, e.g., semantic shifts, changes in syntax and rhyme, regional and social variations. Examination of selected works according to interests of the class. Ms. Duckert.
- 712. STUDIES IN RHETORIC AND PROSE STYLE.**
Brief readings in Plato and Aristotle as well as in the "new rhetorics" of our own time. Detailed problems in the study of style: words and meanings, the implications of sentence structures, irony, metaphor, the cliché.
Credit, 3 for two semesters. Mr. Gibson.
- 718. THE ENGLISH LITERARY PROFESSION.**
An introduction to the professional standards, aims, and procedures of scholarship and criticism. Mr. Kinney.
- 721. THE DEVELOPMENT OF THE ENGLISH NOVEL.**
Readings in the English novel to the late 19th century, from Richardson to Conrad, with attention to some ten representative novels. Mr. Page, Mr. Golden, Ms. Wolff.
- 730. LITERATURE OF THE 16TH CENTURY.**
Christian and Humanist ideals reflected in the poetry of Skelton, Wyatt, Surrey, Sackville, Raleigh, Sidney, and Spenser. Mr. Spivack, Mr. Kinney.
- 731. THE ENGLISH BIBLE AS LITERATURE.**
The several main genres of Biblical literature in their historical setting. Principles in interpretation; the literary influence of the Authorized Version. Mr. Freeman.
- 732. SHAKESPEARE.**
Close examination of Shakespearian plays representing the characteristics of his dramatic art.
Mr. Spivack, Ms. Spivack, Mr. Berlin, Mr. Donohue, Mr. Farrell, Mr. Jorgens.
- 734. ELIZABETHAN AND JACOBAN DRAMA.**
Representative plays by Shakespeare's contemporaries, 1580-1642; emphasis on works by Marlowe, Jonson, Beaumont and Fletcher, and Ford.
Ms. Spivack, Mr. Berlin.
- 737. LITERATURE OF THE 17TH CENTURY.**
Readings in 17th century prose and poetry from Donne to Marvell; analysis of the more significant areas of thought and style.
Mr. Frank, Mr. Koehler, Mr. Cheney, Mr. Shadoian.
- 738. MILTON.**
The major and some of the minor works; related studies in Milton scholarship and criticism.
Mr. Koehler, Mr. Freeman, Ms. Swaim.
- 740. LITERATURE OF THE RESTORATION AND 18TH CENTURY.**
Readings in English poetry and prose from Dryden to Burns, emphasizing the major writers and including representative plays. Mr. Golden, Mr. Weston, Ms. Wolff.
- 745. LITERATURE OF THE ROMANTIC PERIOD.**
Readings in the major poetry, representative essays, and selected critical writings, including Blake, Coleridge, Wordsworth, Keats, Shelley, Byron, and Hazlitt.
Mr. Haven, Mr. Brogan, Mr. Bagg, Mr. Barnard, Mr. Ashton.
- 746. LITERATURE OF THE VICTORIAN AGE.**
Readings in the chief poets and prophets of the Victorian Age. Emphasis on Browning, Tennyson, Carlyle, Newman, Mill, Ruskin, Arnold, and Pater.
Mr. Wolff, Mr. Silver, Mr. Noland, Ms. Raymond.
- 750. EARLY AMERICAN LITERATURE.**
The major writers and intellectual movements in America during the 17th and 18th centuries.
Mr. Emerson, Mr. Lowance.
- 753. AMERICAN ROMANTICISM.**
The development of American romanticism, under European influence, stressing Cooper, Emerson, Thoreau, Poe, Hawthorne, Whitman, and Melville. Mr. Kaplan, Mr. McCarthy, Mr. Emerson, Mr. Plumstead.
- 755. AMERICAN REALISM.**
The development of American realism from 1865 to 1914, stressing Twain, Henry James, Howells, and Henry Adams. Mr. O'Donnell, Mr. Turner.
- 770. CONTEMPORARY DRAMA.**
British and American Drama from 1950 to the present. Mr. Rudin.
- 771. CONTEMPORARY FICTION.**
British and American fiction from 1945 to the present. Mr. Moran, Mr. Powers, Mr. Nelson.
- 772. CONTEMPORARY POETRY.**
British and American poetry from 1945 to the present. Mr. Langland, Mr. Tucker, Mr. Junkins.
- 774. LITERARY CRITICISM.**
Critical theory and practice with emphasis on the major philosophical critics beginning with Plato and Aristotle. Mr. Copeland, Mr. Clark, Mr. Jayne.
- 775. MODERN DRAMA.**
Modern British, Irish, and American drama from 1890 to 1950. Emphasis on major figures: Shaw, Synge, O'Neill. Mr. Rudin, M. Hogan, Mr. Donohue.
- 776. MODERN FICTION.**
Intensive study, including papers and oral reports of important works by Henry James, Joseph Conrad, James Joyce, D. H. Lawrence, William Faulkner and other masters of the modern novel between about 1900 and 1940. Mr. Chametzky, Mr. Clayton, Mr. Hicks.
- 777. MODERN POETRY.**
The growth and development of modern poetry in English from 1912 to WW II, including those poets who came to prominence during that period: Yeats, Stevens, Frost, Eliot, Pound, Williams; also Cummings, L. Hughes, Moore, Ransom, Auden, Crane, Robinson. Brief background materials out of Hopkins, Dickinson, and Hardy. Mr. Clark, Mr. Koehler, Mr. Mariani.
- 780. IMAGINATIVE WRITING: POETRY.**
Writer's workshop with emphasis on poetry. May be repeated by candidates for the M.F.A. for a total of 12 credits. Mr. Langland, Mr. Tucker, Mr. Junkins.
- 781: IMAGINATIVE WRITING: PROSE.**
Writer's workshop with emphasis on fiction. May be repeated by M.F.A. candidates for a total of 12 credits. Mr. Fetter, Mr. Swados, Mr. Aczel, Mr. Neugeboren.
- 790. FOLKLORE.**
Folk narrative: tale, myth, and legend in relation to written literature. Ms. Campbell, Mr. Carey, Mr. Turner.

- 810-819. SEMINARS IN ENGLISH LITERATURE.
Credit, 3 each semester.
- 820-829. SEMINARS IN THE ENGLISH LANGUAGE.
Credit, 3 each semester.
- 830-839. SEMINARS IN AMERICAN LITERATURE.
Credit, 3 each semester.
- 840-849. SEMINARS IN CRITICISM.
Credit, 3 each semester.
- 850-859. SEMINARS IN EDITING.
Credit, 3 each semester.
- 860-869. SEMINARS IN WRITING.
Credit, 3 each semester.
- 870-879. SEMINARS IN LINGUISTICS.
Credit, 3 each semester.
800. MASTER'S THESIS.
May be repeated by M.F.A. candidates for a total of 12 credits. *Credit, 3-9.*
900. DOCTORAL DISSERTATION. *Credit, 15-30.*

COURSE OPEN TO BOTH GRADUATE AND UNDERGRADUATE STUDENTS
(For either major or minor credit)

634. ADVANCED TECHNICAL WRITING.
Case studies in engineering and industrial reporting, advertising, and promotional literature, scientific journalism, and graphic techniques. Given in alternate years. Prerequisite, permission of instructor. Mr. Mitchell.

RELATED COURSES

See Comparative Literature.

Entomology

GRADUATE FACULTY

T. MICHAEL PETERS, *Head of the Department of Entomology, Director of Graduate Studies and Associate Professor*, B.S., Long Beach State College, 1959; M.S., Minnesota, 1961; Ph.D., 1964.

WILLIAM B. BECKER, *Professor*, B.S., New York State College of Forestry at Syracuse University, 1934; M.S., Massachusetts, 1937; Ph.D., 1945.

LAWRENCE J. EDWARDS, *Assistant Professor*, B.S., State University of New York, 1962; M.S., Cornell, 1965; Ph.D., 1967.

DONALD W. HALL, *Assistant Professor*, B.S., Purdue University, 1964; M.S., 1967; Ph.D., University of Florida, 1970.

JOHN F. HANSON, *Professor*, B.S., Massachusetts, 1937; M.S., 1938; Ph.D., 1943.

GARY L. JENSEN, *Assistant Professor*, B.S., Brigham Young University, 1962; M.S., 1963; Ph.D., University of California, Berkeley, 1968.

JOHN H. LILLY, *Professor*, B.S., Wisconsin, 1931; Ph.D., 1935.

WILLIAM D. MCENROE, *Associate Professor*, B.S., Connecticut, 1950; M.S., 1952; Ph.D., Rutgers, 1956.

JOHN A. NAEGELE, *Professor*, B.S., Cornell, 1949; Ph.D., 1952.

JOHN G. STOFFOLANO, *Assistant Professor*, B.S., State University of New York at Oneonta, 1962; M.S., Cornell, 1967; Ph.D., Connecticut, 1970.

WILLIAM E. TOMLINSON, JR., *Professor*, B.S., Tufts, 1936; M.S., Massachusetts, 1938.

WILLIAM D. TUNIS, *Professor*, B.S., Massachusetts, 1949; M.S., Minnesota, 1951; Ph.D., Massachusetts, 1959.

A candidate for the Master of Science degree in Entomology, in addition to meeting the requirements of the Graduate School must ordinarily complete the course requirements of Entomology 655, 656, 657, 680, 682, and related sciences or their equivalents, plus Entomology 579, 770, and other courses assigned by the student's adviser. A thesis is usually required, but in special cases course credits in the 700-800 series, including at least three credits in Ent. 700, may be substituted.

Requirements for the Doctor of Philosophy degree include the course requirements for the M.S. degree, as well as those established by the Graduate School and by the student's Guidance Committee. Journal-level reading competency in one foreign language will be determined by a Departmental committee.

ALL COURSES CARRY 3 CREDITS UNLESS OTHERWISE SPECIFIED

COURSES OPEN TO GRADUATE STUDENTS ONLY

(For either major or minor credit)

(Most graduate-level courses in the department are given on a rotating basis, subject to change on student demand.)

700. SPECIAL PROBLEMS.

Research on some problem in Entomology. If submitted in lieu of a thesis, original research is expected; and two copies of a written report, approved by two members of the staff, are required by the Department.

Credit, 1-6 per semester.

705. PRINCIPLES OF PLANT PROTECTION.

Fundamentals of insecticidal action, natural factors governing insect abundance and activity, infection and disease development, chemical control, cultural practices, quarantine and eradication, host resistance and pathogen variability and weed control. Offered only at the Waltham Field Station.

745. HISTORICAL ENTOMOLOGY.

Lives and works of outstanding entomologists of the world, history of entomology. Prerequisite, permission of instructor.

Credit, 2. Mr. Lilly.

770. RESEARCH METHODS.

An orientation course for incoming graduate students. Stresses research principles, methods of analysis, including the use of analytical laboratory equipment, and presentation of results.

Credit, 1. Mr. Edwards, Mr. Stoffolano.

790. SEMINAR.

Reports on the current literature of entomology; special reports by resident and visiting speakers. Participation by all graduate students is expected. One class hour.

(May be repeated by M.S. candidates for a maximum of 2 credits; by Ph.D. candidates for 4.)

Credit, 1 each semester.

803. INSECT DEVELOPMENT.

Introduction to reproductive systems, gametogenesis, fertilization, unusual methods of reproduction, adaptations of the insect egg and embryo to survival, and the biological success of insects. Recent advances in entomology related to pre- and postembryonic regulation of development by interactions at all levels of organization; molecular, organelle, cellular, and tissue. Prerequisite, permission of instructor. Mr. Stoffolano.

814. ADVANCED ANIMAL ECOLOGY.

Basic principles of terrestrial, limnological, and marine ecology; emphasis on the influence of causal factors, both physical and biotic, that regulate the activities of all organisms.

Prerequisite, Ent 579 or equivalent.

Mr. Peters.

821. INSECT TOXICOLOGY.

The chemistry of insecticides and their physiological effects on insects, man, and other animals.

Prerequisite, permission of instructor.

Mr. Edwards.

822. INSECT MICROBIOLOGY AND PATHOLOGY.

The diseases of insects including the classification and biology of the pathogens involved. Emphasis on bacterial, fungal, protozoan, and viral pathogens of insects, and the research techniques used to study them.

Prerequisite, permission of instructor.

Mr. Hall.

823. ADVANCED BIOLOGICAL CONTROL.

The basic principles and practical application of biological control of insects. A section devoted to control of pest weeds with insects.

Prerequisite, Ent 680 or equivalent.

842. ADVANCED ARTHROPOD TAXONOMY.

Classification of selected insects and insect allies, including latest methods in taxonomy and principles of classification.

Prerequisite, permission of instructor.

Credit, 1-9.

A. Immature stages of insects.

B. Minor order of insects.

Mr. Hanson.

C. Arthropods other than insects.

Mr. Hanson.

D. Other groups of insects.

848. PRINCIPLES OF SYSTEMATIC ENTOMOLOGY.

The species concept; type categories; the Zoological Code. The preparation of a taxonomic paper of publication quality, including drawing, required.

Prerequisites, Ent 655, 656.

Mr. Hanson.

850. ADVANCED MEDICAL ENTOMOLOGY.

Detailed studies of insects as parasites of man and animals. Biology, vector-relationship, taxonomy, and control.

Prerequisite, Ent 674 or equivalent.

Mr. Hall.

800. MASTER'S THESIS.

Credit, 10.

900. DOCTORAL DISSERTATION.

Maximum Credit, 30.

COURSES OPEN TO BOTH GRADUATE AND UNDERGRADUATE STUDENTS (For either major or minor credit)

566. APICULTURE.

Honeybees and their relatives; structure, behavior, and biology of bees; bee management, diseases, queen rearing, and honey production; history of apiculture. Two class hours. One 2-hour laboratory period.

Prerequisite, Ent 126 or permission of instructor.

Mr. Edwards.

572. FOREST AND SHADE-TREE INSECTS.

The principles and methods of controlling insects which attack shade trees, forests, and forest products. The more important species, their identification, biology, and specific control measures.

Two class hours, two 2-hour laboratory periods.

Credit, 4. Mr. Becker.

579. ANIMAL ECOLOGY.

Basic principles and concepts operative at the various levels of biological organization (organismic, population,

community, and ecosystem). Topics covered: ecology and natural selection, behavioral ecology, human ecology, and current ecological problems such as pollution, overpopulation, etc. An optional 3-hour, 1-credit laboratory for an independent ecology research project.

Credit, 3 (or 4). Mr. Stoffolano.

590. EVOLUTION.

The course and dynamics of both inorganic and organic evolution; the implications of evolutionary concept on human philosophy, behavior, and welfare.

Mr. Hanson.

611. INSECT BEHAVIOR.

The specific behaviors of insects, analyzed in view of current experimental research, and used to demonstrate various neurobiological principles. The behavioral dynamics of a specific insect; how that organism's behavior insures survival under diverse environmental stresses. An optional 3-hour, 1-credit lab for an independent research project. Lab period also includes several formal sessions introducing various techniques and equipment involved in behavioral research.

Credit, 3 (or 4). Mr. Stoffolano.

655 (I), 656 (II). CLASSIFICATION OF INSECTS.

The identification of insects, including immature stages. First semester: Orthoptera, Hemiptera, Coleoptera; second semester: other orders. Either semester may be elected independently.

Three 2-hour laboratory periods.

Prerequisite, permission of instructor; Ent 126 desirable.

Credit, 3 each semester.

657. INSECT MORPHOLOGY.

The external and internal anatomy of the major orders, with stress on phylogenetic relationships, as background for subsequent work in taxonomy and physiology of insects.

One class hour, three 2-hour laboratory periods.

Prerequisite, permission of instructor, Ent 126 desirable.

Credit, 4. Mr. Hanson.

674. MEDICAL AND VETERINARY ENTOMOLOGY.

Relationships of insects and their allies to the health of man and animals. The classification, biology, and control of these pests.

One class hour, two 2-hour laboratory periods.

Prerequisite, Ent 126 or permission of instructor.

Mr. Hall.

680. INSECT CONTROL.

The science of pest control. Biological control, and the need, economics, effectiveness, and hazards from insecticides are emphasized.

Prerequisite, Ent 126; Ent 579 and 682 desirable.

Mr. Lilly.

681. INSECT PEST MANAGEMENT.

Application of the principles of insect pest management with emphasis on pest recognition, properties of available control agents and their correct use in planning control programs.

Prerequisite, Ent 680 and 126, or permission of instructor.

Mr. Jensen.

682. INSECT PHYSIOLOGY.

Detailed consideration of the organ systems, showing their functions in nutrition, reproduction, respiration, and growth, and the relationship of physiology to behavior.

One class hour, two 2-hour laboratory periods.

Prerequisites, Ent 126 and permission of instructor.

Mr. Edwards.

COURSE NOT FOR MAJOR CREDIT

(No graduate credit for students majoring in Entomology)

560. FOOD AND STRUCTURAL PESTS.

Biology, recognition, damage, and principles of control relating to those insects and other pests which damage

foods, fabrics, and buildings. A prior course in zoology or entomology desirable. Mr. Lilly.

Environmental Engineering

(see Civil Engineering)

Environmental Sciences

(Not a degree-granting program)

(See Department of Food Science and Technology, Institute of Agricultural and Industrial Microbiology, for Graduate Faculty listing)

ALL COURSES CARRY 3 CREDITS UNLESS OTHERWISE SPECIFIED

COURSES OPEN TO GRADUATE STUDENTS ONLY

745. MICROBIAL ECOLOGY OF THE SOIL

(Pl & Soil 745).

(See Plant and Soil Sciences.)

Prerequisite, Pl & Soil 585 or permission of instructor. Mr. Gunner.

COURSES OPEN TO BOTH GRADUATE AND UNDERGRADUATE STUDENTS

(For either major or minor credit)

501. INTRODUCTORY ENVIRONMENTAL BIOLOGY.

The response of the biota to environmental stress induced by air, water, and soil pollutants.

Prerequisites, Botany 101, Zool 101, or equivalent.

Three class hours, demonstrations, field trips.

Mr. Gunner.

602. ADVANCED ENVIRONMENTAL BIOLOGY.

The measurement and evaluation of the biotic response to environmental stress of the terrestrial and aquatic biocoenoses induced by air, water, and soil pollutants.

Two 1-hour lectures, two 3-hour laboratory sessions, field trips, demonstrations.

Prerequisite, Env Sci 501 or equivalent. Credit, 4.

550. MICROBIAL ECOLOGY OF MARINE ENVIRONMENT.

The ecology, function, and importance of microorganisms in the marine environment including the underlying sediments, their role in the food chain and productivity of the seas and estuaries, and the factors influencing seasonal and geographical population dynamics.

Credit, 2. Mr. Litsky.

585. MICROBIOLOGY OF THE SOIL

(Pl & Soil 585).

Soil microorganisms; their distribution, ecology, and transformation of organic and inorganic substrates. Microbiology of the rhizosphere and the biological equilibrium.

Prerequisite, Microbiol 250 or permission of instructor.

Mr. Gunner.

586. SPECIAL PROBLEMS.

Individual work on an assigned problem or project in the field of environmental sciences. Credit, 1-3.

Exercise Science

GRADUATE FACULTY

DAVID C. BISCHOFF, *Dean of the School of Physical Education and Professor*, B.S., Pennsylvania State,

1952; M.Ed., North Carolina, 1953; Ph.D., Pennsylvania State, 1958.

BENJAMIN RICCI, JR., *Chairman and Professor*, B.S., Springfield College, 1949; M.Ed., 1950; D.P.E., 1958.

HARRY K. CAMPNEY, JR., *Professor*, B.S., Pittsburgh, 1952; M.S., Illinois, 1953; Ph.D., Iowa, 1960.

DEE W. EDINGTON, *Assistant Professor*, B.S., Michigan State, 1959; M.S., Florida State, 1963; Ph.D., Michigan State, 1968.

ROBERT J. JAMES, *Associate Professor*, B.S., Springfield College, 1954; M.S., 1957; B.S., Connecticut, 1964; Ph.D., University of Wisconsin, 1972.

WALTER KROLL, *Professor*, B.S., Northern Illinois, 1952; M.S., Illinois, 1953; P.E.D., Indiana, 1959.

STANLEY PLACENHOEF, *Professor*, B.S., Michigan, 1949; M.S., 1951; Ph.D., 1962.

The Department of Exercise Science (motor integration, biomechanics, exercise biochemistry, and exercise physiology) offers programs of study leading to a Master of Science degree in physical education (see Physical Education) and a Doctor of Philosophy degree in human movement. Students in the M.S. program may concentrate their studies in exercise science or they may opt to follow a general program of study in physical education which may include several courses in exercise science. Doctoral students specialize in exercise science.

In addition to the requirements for admission to the Graduate School, the department requires an applicant to present certain undergraduate courses. The undergraduate preparation needed for admission varies with the degree program. However, in the event that any of these entrance requirements have not been satisfied, the applicant will be required to remove his deficiencies without graduate credit.

The degree requirements include 31 graduate credits for the M.S. degree and approximately 90 graduate credits for the Ph.D. degree. In both degree programs the majority of these credits are earned in exercise science courses, but at least 6 semester hours (M.S.) or 18 semester hours (Ph.D.) must be elected from the offerings of other departments. The credits earned in the department come from both required and elective courses in both degree programs.

ALL COURSES CARRY 3 CREDITS UNLESS OTHERWISE SPECIFIED

COURSES OPEN TO GRADUATE STUDENTS ONLY
(For either major or minor credit)

700. SPECIAL PROBLEMS.

Individual research on a topic not covered by other courses. Normally confined to an extension of the content of an existing course rather than an introduction to a new area of study.

Prerequisites, permission of instructor and Department Chairman. Credit, 1-6.

711. INTRODUCTION TO RESEARCH IN HUMAN MOVEMENT.

The nature of research; methods of acquiring knowledge; research and social progress; general concepts concerning the scientific method.

Credit, 1. Mr. Campney.

**712. DATA ANALYSIS AND INTERPRETATION
IN HUMAN MOVEMENT RESEARCH.**

Theory and techniques involved in the analysis and interpretation of data pertinent to research in human movement. Parametric and non-parametric inference statistics applied to data encountered in human movement research.

Prerequisite, Stat 121.

Mr. Campney.

**722. EXERCISE-PHYSIOLOGY INSTRUMENTATION
THEORY.**

Instrumentation theory relative to the equipment utilized in estimating parameters in exercise physiology.

Prerequisites, Zool 135, Ex Sci 278 and 621.

Mr. Ricci.

732. BIOMECHANICS.

Physical and biological considerations applied to the teaching of motor skills.

Prerequisites, Ex Sci 204, 205, and 631.

Mr. Plagenhoef.

742. MOTOR INTEGRATION PRACTICUM.

Theory and practice in laboratory analysis of gross motor functions. Topics include nerve conduction velocity, reflex latency, response and reaction time, and electromyographic analysis of local muscular fatigue as related to skilled and unskilled gross motor performance.

Prerequisites, Ex Sci 204, 205, 278, 641, Zool 135.

Mr. Kroll.

**813. MEASUREMENT THEORY AND HUMAN
MOVEMENT RESEARCH.**

The theory of the construction of evaluative instruments in human movement. Emphasis on a critical examination of existing measurement devices.

Prerequisites, Ex Sci 274 and 712.

Mr. Campney.

**823. EXPERIMENTAL PHYSIOLOGY OF
EXERCISE.**

Experimental investigation of the physiological effects of exercise.

Prerequisite, Ex Sci 621.

Mr. Ricci.

**824. TISSUE RESPIRATORY RESPONSES TO
EXERCISE.**

Tissue respiration in response to selected stress conditions.

Prerequisite, Ex Sci 621.

Mr. Edington.

825. EXERCISE METABOLISM.

The factors affecting human metabolism under exercise conditions. Emphasis on endocrine function.

Prerequisite, Ex Sci 621.

Mr. Edington.

**833. FORCES AND MOMENTS OF FORCE
IN HUMAN MOTION.**

The analysis of whole body muscle action during movement and impact.

Prerequisite, Ex Sci 732.

Mr. Plagenhoef.

843. NEUROMUSCULAR FATIGUE.

Analysis of fatigue and recovery processes in gross human motor activity.

Prerequisites, Ex Sci 621, 742, 813, and Stat 561.

Mr. Kroll.

844. KINESTHESIA.

Anatomical and functional analysis of the kinesthetic phenomena in gross human motor activity.

Prerequisites, Ex Sci 641, Psych 511, and Stat 581.

Mr. Kroll.

899. SEMINAR IN HUMAN MOVEMENT.

Topics in human movement not covered in other courses.

Credit, 1 per semester; Maximum credit, 6.

800. MASTER'S THESIS.

Credit, 3-6.

900. DOCTORAL DISSERTATION.

Credit, 12.

**COURSES OPEN TO BOTH GRADUATE AND
UNDERGRADUATE STUDENTS**
(For either major or minor credit)

**621. PHYSIOLOGICAL BASIS OF HUMAN
PERFORMANCE.**

Analysis and interpretation of cardiovascular-pulmonary adjustment, metabolic requirement, and heat regulation during exercise.

Prerequisite, Ex Sci 278.

Mr. Ricci.

**631. MECHANICAL ANALYSIS OF HUMAN
MOTION.**

Application of the principles of mechanics to the analysis of human motion.

Prerequisites, Ex Sci 204 and 205.

Mr. Plagenhoef.

641. MOTOR INTEGRATION.

The control of muscular activity by the nervous system. Topics include basic motor-system reflexes, cross transfer, fatigue, kinesthetic sense, lateral dominance, and neuromuscular facilitation techniques.

Prerequisites, Ex Sci 204, 205, 278, and Zool 135.

Mr. Kroll.

651. THEORY OF THERAPEUTIC EXERCISE.

Theory of therapeutic exercise for the mentally retarded, physically handicapped, and normal.

Prerequisite, Ex Sci 259.

Mr. James.

**652. PHYSICAL ACTIVITY AND MENTAL
RETARDATION.**

Physical activity relative to the behavior of the mentally retarded.

Prerequisite, Ex Sci 259.

Mr. James.

Food and Agricultural Engineering

GRADUATE FACULTY

JOE T. CLAYTON, *Head of the Department of Food and Agricultural Engineering and Professor*, B.S.A.E., Tennessee, 1949; M.S., Illinois, 1951; Ph.D., Cornell, 1962.

CHIN SHU CHEN, *Assistant Professor*, B.S., National Taiwan University, 1960; M.S., Massachusetts, 1965; Ph.D., North Carolina State, 1968.

TSUAN H. FENG, *Professor of Civil Engineering*.

STEVENSON W. FLETCHER, *Associate Professor*, B.S., Pennsylvania State, 1960; M.S., 1964; Ph.D., Massachusetts, 1970.

CURTIS A. JOHNSON, *Associate Professor*, B.S.A.E., Nebraska, 1940; M.S., Iowa State, 1955.

JOHN S. NORTON, *Associate Professor*, B.S., Pennsylvania State, 1948; M.S., Louisiana State, 1950.

CHOKYUN RHA, *Assistant Professor*, B.S., Massachusetts Institute of Technology, 1962; M.S., 1964; M.S., 1966; Ph.D., 1967.

RICHARD J. SMITH, *Assistant Professor*, B.S., Kings College, Univ. of London, 1962; M.S., Iowa State, 1967; Ph.D., 1971.

LESTER F. WHITNEY, *Associate Professor*, B.S., Maine, 1949; M.S., Michigan State, 1951; Ph.D., 1963.

Master of Science and Doctor of Philosophy programs in Food and Agricultural Engineering involve studies of the engineering aspects of the production, preservation, storage, processing, and distribution of food. Academic backgrounds, as well as programs of study, may differ markedly depending upon the aims

of the student and the area of emphasis he selects. Students working in any emphasis-area must have a background in the physical and engineering sciences and have, or be prepared to acquire, a basic knowledge of the biological sciences.

Requirements for both the M.S. and Ph.D. degrees include courses offered by the Department of Food and Agricultural Engineering and courses in supporting areas, such as food science, mechanical, chemical, and civil engineering; mathematics; and the biological and microbiological sciences. A typical Ph.D. program includes approximately one-third major department offerings, one-third course work in supporting areas, and one-third dissertation. The department imposes no foreign language requirements for the doctoral degree.

ALL COURSES CARRY 3 CREDITS UNLESS OTHERWISE SPECIFIED

COURSES OPEN TO GRADUATE STUDENTS ONLY

(For either major or minor credit)

700. SPECIAL PROBLEMS IN FOOD AND AGRICULTURAL ENGINEERING.

Current topics pertinent to students' interests and departmental goals. Includes analysis, experimentation, and/or literature review. The special problem culminates with an unbound written report, often of publishable quality. *Credit, 1-6.*

740. PHYSICAL PROPERTIES OF BIOLOGICAL MATERIALS.

The physical characteristics and mechanical, rheological, thermal, electrical, and optical properties of biological materials. Emphasis on the application of fundamental concepts of mechanical and thermal behavior in actual handling, storage, processing, quality-evaluation and manipulation.

2 class hours, 1 2-hour period.

Prerequisite, permission of instructor.

Ms. Rha.

756. ENGINEERING ANALYSIS OF BIOLOGICAL SYSTEMS.

Methods of mathematical modeling as a supplement to laboratory experiments. Analysis of biological problems in an engineering context, and the physical and mathematical interpretation of the results. Non-equilibrium thermodynamics, diffusional processes, and selected mathematical models of biological systems.

Prerequisite, Math 585 or approval of department.

Mr. Chen.

760. PHYSICAL AND PHYSIOLOGICAL RELATIONSHIPS IN ANIMAL ENVIRONMENTS.

(In cooperation with Department of Veterinary and Animal Sciences)

Functional environment contrasted to the generalized environment. The action of the environment on the animal and the reaction of the animal on the environment in terms of several parameters: radiant energy, light, temperature, atmospheric composition, air flow, ambient pressure, etc. Modification of natural environments to vary physiological response.

Prerequisite, permission of instructor.

Mr. Clayton, Mr. Mellen.

766. CONTROL OF HEAT AND VAPOR FLOW IN BUILDINGS AND PROCESSES.

Application of mass flow theory to heat and vapor transfer. Thermal and gaseous interchange between animals and biological products and their environments. The application of instruments and controls.

Prerequisite, Mech Eng 582 or equivalent.

Mr. Chen.

776. ADVANCED FOOD-MACHINERY DESIGN.

Food machinery component design problems. Analysis, such as finite differences, energy, and graphic methods, as well as conventional approaches. The interrelation of the physical properties of biological material, with problems related to the food industry. Shell theory and vessel design. A design problem is required of each student.

Prerequisite, permission of the department, or Mech Eng 283 and Math 285 or equivalents.

Mr. Whitney.

780. BIOPHYSICS IN AGRICULTURAL ENGINEERING.

The properties of certain living systems in terms of the concepts of physics and engineering; includes the biophysical concept of the living cell; the theory of controlling regimes and biological rate processes; scalar problems pertaining to industrial applications; the instrumentation for kinetic studies involving heat and pressure in biological systems.

Prerequisite, Food and Ag Eng 781.

Credit, 4

781. BIOLOGICAL PROCESS ENGINEERING.

Dimensional analysis and reaction kinetics as applied to pilot plant procedures and the scale-up of biological processes for system design.

Prerequisite, Food and Ag Eng 681.

Ms. Rha.

786. ADVANCED PROCESS ENGINEERING.

A comparative engineering evaluation and analysis of agricultural product processes including: thermal processing, ionizing radiation processing, freeze drying, dehydration, fermentation, and controlled atmospheres.

791. SEMINAR.

Research methods in Food and Agricultural Engineering.

Credit, 1.

792. SEMINAR.

Research accomplishments in Food and Agricultural Engineering.

Credit, 1.

891. PROFESSIONAL TOPICS IN FOOD AND AGRICULTURAL ENGINEERING.

Credit, 1 each semester. Maximum credit, 2.

892. TECHNICAL TOPICS IN FOOD AND AGRICULTURAL ENGINEERING.

Credit, 1 each semester. Maximum credit, 2.

800. MASTER'S THESIS

Credit, 4-8.

900. DOCTORAL DISSERTATION.

Credit, 30.

COURSES OPEN TO BOTH GRADUATE AND UNDERGRADUATE STUDENTS

(For either major or minor credit)

555. AQUACULTURAL ENGINEERING SYSTEMS (OE 591).

Rate theory and similitude in the scale-up of biological processes. Case study of biological data used in the derivation of useful engineering systems design relationships for the culture of mollusks. A bio-engineering comparison of several systems used in aquaculture. A field trip to inspect an aquacultural project in operation.

631. INSTRUMENTATION IN FOOD AND AGRICULTURAL ENGINEERING.

Instrumentation applied to research, covering recorders, indicators, controllers and transducers in general. Emphasis on applications and limitations.

Prerequisite, permission of instructor.

Mr. E. Johnson.

665. PHYSIOLOGICAL UNIT OPERATIONS.

Introduction to physiological systems, studies of thermodynamics, fluid dynamics, heat transfer and mass transfer in biological systems, concepts in biological regulatory systems and biological engineering design with specific examples.

Ms. Rha.

675. FOOD PROCESSING SYSTEMS ANALYSIS. Continuous and batch processing systems for food and biological products. Flow analysis; systems analysis, scale-up, and simulation techniques. Machine operating principles, sanitary requirements, fabrication limitation and machine interactions. Laboratory exercises directed towards flow analysis, plant layout, and systems analysis for existing plant operations.
Prerequisite, permission of instructor. Mr. Whitney.

681. ELEMENTS OF FOOD UNIT OPERATIONS. The fundamental engineering principles involved in the processing of biological materials. Emphasis on heat transfer, mass and energy balances, refrigeration, psychrometry, properties of fluids and fluid flow.
Mr. Fletcher.

683. APPLICATIONS OF FOOD ENGINEERING. Application of engineering concepts to the processing and handling of biological materials, including evaporation, dehydration, irradiation, freeze drying, cost analysis, materials handling, manual motion, economy, and packaging.
Mr. Fletcher.

Food Science and Technology

GRADUATE FACULTY

FREDERICK J. FRANCIS, *Head of the Department of Food Science and Technology*, B.A., University of Toronto, 1946; M.A., 1948; Ph.D., Massachusetts, 1954.

PETER M. BLUESTEIN, *Assistant Professor*, B.Ch.E., Rensselaer Polytechnic Institute, 1966; Ph.D., Massachusetts Institute of Technology, 1971.

ERNEST M. BUCK, *Associate Professor*, B.S., University of Connecticut, 1955; M.S., North Carolina State, 1957; Ph.D., Massachusetts, 1966.

FERGUS M. CLYDESDALE, *Associate Professor*, B.A., Toronto, 1960; M.S., 1962; Ph.D., Massachusetts, 1966.

WILLIAM B. ESSELEN, *Professor*, B.S., Massachusetts, 1934; M.S., 1935; Ph.D., 1938.

DAVID A. EVANS, *Assistant Professor*, B.S., Pennsylvania State, 1953; M.S., 1955; Ph.D., Massachusetts, 1968.

IRVING S. FAGERSON, *Professor*, B.S., Massachusetts Institute of Technology, 1942; M.S., Massachusetts, 1948; Ph.D., 1950.

DENZEL J. HANKINSON, *Professor*, B.S., Michigan State, 1937; M.S., Connecticut, 1939; Ph.D., Pennsylvania State, 1942.

KIRBY M. HAYES, *Professor*, B.S., Massachusetts, 1947; M.S., 1948.

HERBERT O. HULTIN, *Professor*, B.S., Massachusetts Institute of Technology, 1956; M.S., 1956; Ph.D., 1959.

WARD M. HUNTING, *Assistant Professor*, B.S. Houghton College, 1947; M.S., Massachusetts, 1949; Ph.D., 1963.

ROBERT E. LEVIN, *Associate Professor*, B.S., Los Angeles State College, 1952; M.S., Southern California, 1954; Ph.D., California, 1963.

WASSEF W. NAWAR, *Professor*, B.S., University of Cairo, 1947; M.S., 1950; Ph.D., Illinois, 1960.

UNIVERSITY OF MASSACHUSETTS

FRANK E. POTTER, *Associate Professor*, B.S., Maine, 1942; M.S., Maryland, 1948; Ph.D., Pennsylvania State, 1955.

F. MILES SAWYER, *Associate Professor*, B.S., Massachusetts Institute of Technology, 1948; M.S., California, 1951; Ph.D., 1958.

CHARLES R. STUMBO, *Professor*, B.S., Kansas State, 1936; M.S., 1937; Ph.D., 1941.

INSTITUTE OF AGRICULTURAL AND INDUSTRIAL MICROBIOLOGY

WARREN LITSKY, *Director of Agricultural and Industrial Microbiology and Commonwealth Professor of Environmental Sciences*, B.S., Clark University, 1945; M.S., Massachusetts, 1948; Ph.D., Michigan State, 1951.

ROBERT A. COLER, *Assistant Professor of Agricultural and Industrial Microbiology*, B.A., State University of New York, 1952; M.A., 1954; Ph.D., Syracuse University, 1960.

HAIM B. GUNNER, *Associate Professor of Agricultural and Industrial Microbiology*, B.S., University of Toronto, 1946; M.S., University of Manitoba, 1948; Ph.D., Cornell, 1962.

ROBERT W. WALKER, *Research Instructor in Agricultural and Industrial Microbiology*, B.S., Massachusetts, 1955; M.S., 1959; Ph.D., Michigan State, 1963.

Graduate students who wish to major in food science and technology may not be admitted to candidacy for an advanced degree until such time as the undergraduate requirements in basic sciences and department courses have been met substantially. Work in the area of dairy technology is included in the offerings of the Department of Food Science and Technology.

Industrial microbiology is offered as an area of concentration for the Ph.D. degree in the Department of Food Science and Technology in cooperation with the Institute of Agricultural and Industrial Microbiology.

All general Graduate School requirements for admission and for the degree must be met with the following additional requirements:

1. All Ph.D. candidates will offer as a minimum, 15 credits of departmental 800-level courses, 3 credits of seminar, and 9 credits outside the department in certain courses more advanced than those recommended for undergraduate majors.

2. Competency in computer usage and programming is required of all Ph.D. candidates.

3. The Department of Food Science and Technology requires no foreign language competency for the doctoral degree.

4. Candidates for the M.S. degree may select one of three options, in order to fulfill the Graduate School requirements.

- a. M.S. degree with thesis. Ten credits may be allowed for the thesis.

- b. M.S. degree with research problem. Up to 6 credits may be allowed for the problem.

- c. M.S. degree with course credits only.

5. Candidates for the non-thesis M.S. degree in options b and c above must submit at least 9 credits

of departmental 800-courses and 2 credits of seminar. The non-thesis options b and c are not open to candidates holding a departmental research assistantship.

ALL COURSES CARRY 3 CREDITS UNLESS OTHERWISE SPECIFIED

COURSES OPEN TO GRADUATE STUDENTS ONLY

(For either major or minor credit)

700. RESEARCH PROBLEM.

Mainly for candidates for the Master of Science degree who do not write a thesis. Original research expected. Two bound copies of a written report of the study are required by the department. *Credit, 3-6.*

703. RESEARCH PROJECT.

Research on problems not related to the thesis. *Credit, 1-4.*

802. ADVANCED DAIRY CHEMISTRY.

The physical, colloidal, and chemical properties of dairy products and the role of milk fat, salts, proteins, carbohydrates, and enzyme systems. Two class hours. Prerequisite, permission of instructor. Mr. Potter.

809. MICROBIOLOGY AND FOOD PROCESSING.

Relationship of yeasts, molds, and bacteria to foods. Invasion of plant tissue by microorganisms. Microbiology of frozen and refrigerated foods. Ionizing radiation preservation. Alcohol and lactic acid fermentations and vinegar production. Two class hours, one 3-hour laboratory period. Prerequisites, food processing, basic biochemistry and microbiology, and permission of instructor. Mr. Levin.

810. THERMOBACTERIOLOGY AND FOOD PROCESSING.

Bacteria of importance in spoilage of canned foods. Bacterial contamination and its control. Thermal resistance of bacteria. Heat transfer in thermally processed foods. Calculation and evaluation of sterilization processes. Prerequisites, FS&T 809 and calculus. Mr. Stumbo.

816. FOOD PACKAGING.

Characteristics of packaging materials and how they meet the packaging requirements of various food products. Methods of testing for structural quality and performance including moisture and gas transmission. Evaluation and case studies of current food packages and products. Plant visits in nonscheduled hours. One or more class hours, one 4-hour laboratory period. Prerequisite, FS&T 661. Mr. Hayes.

821. LIPID CHEMISTRY.

Composition and chemical properties of edible fats and oils. Physical characteristics—plasticity, polymorphism, melting, solidification. Technology of industrial fats—extraction, refining, hydrogenation, interesterification. Deteriorative reactions—oxidation, thermal degradation. Biological significance. New methods of analysis. Review of current literature. Two class hours, one 2-hour laboratory period. Prerequisite, permission of instructor. Mr. Nawar.

841. ADVANCED FOOD ANALYSIS.

Instrumental methods. Infrared spectroscopy, gas chromatography and mass spectrometry. Theory, techniques and applications. Two class hours, one 2-hour laboratory period. Prerequisites, FS&T 672 and 684. Mr. Fagerson.

850. COLORIMETRY AND APPEARANCE.

Color theory encompassing the physics and psychophysics of color matching and measurement along with

the physiology of vision. Development of color solids and scales. Interpretation of reflection and transmission data in terms of Munsell, C.I.E., Hunter, MacAdam and other color solids, color tolerances and color differences. Visual and instrumental characterization of color and appearance.

Total of 20 lecture hours and 12 laboratory hours. Prerequisite, permission of instructor. Not open to FS&T majors. *Credit, 2.* Mr. Francis, Mr. Clydesdale.

Two class hours, one 3-hour laboratory period weekly. Prerequisite, permission of instructor.

The extra lectures and laboratory classes will be devoted to color and quality changes with emphasis on foods. *Credit, 3.* Mr. Francis, Mr. Clydesdale.

860. PIGMENTS IN FOODS.

Chemistry, analysis, and processing implications of the anthocyanins, flavonoids, chlorophylls, carotenoids, betacyanins, meat pigments, and nonenzymatic browning systems. Heavily weighted on chemistry but also includes interpretations in terms of appearance, nutritive value and general quality. Complements FS&T 850. Two class hours, one 3-hour laboratory period. Prerequisite, permission of instructor.

Mr. Clydesdale, Mr. Francis.

871 (I), 872 (II). SEMINAR.

Review of current literature and research. Visiting lecturers. One class hour. *Credit, 1. Maximum credit, 6.*

895. BIOLOGICAL AND TOXICOLOGICAL ASSAY OF FOODS.

Laboratory training in making biological assays of good constituents important in human and animal nutrition. Added chemicals in foods. *Credit, 2-5.* Mr. Sawyer.

800. MASTER'S THESIS. *Credit, 10*

900. DOCTORAL DISSERTATION. *Credit, 30.*

COURSES OPEN TO BOTH GRADUATE AND UNDERGRADUATE STUDENTS

(For either major or minor credit)

558. ANIMAL PRODUCTS.

Introduction to the processing, purchasing, handling, and storage of meats and other protein products. Two class hours, one 2-hour lecture-demonstration. Mr. Buck, Mr. Hayes.

652. FOOD CHEMISTRY.

The chemistry of food products. Chemical and biological changes that occur in foods during storage and processing. Emphasis on changes at the cellular and molecular levels. Prerequisite, biochemistry or concurrent registration. Two class hours, one 4-hour laboratory period in alternate weeks. Mr. Hultin.

661. FOOD PROCESSING.

Introduction to the food industry, principles of processing and preservation in current usage. Statistical quality-control procedures. Mr. Bluestein.

662. FOOD-PROCESSING LABORATORY.

Application and utilization of pilot plant equipment to study and evaluate principles of commercial practice in the food industry. Introduction to advanced techniques of food processing. One class hour, one 4-hour laboratory period. Prerequisite, FS&T 661. Mr. Bluestein.

665. UNIT OPERATIONS.

Technical principles involved in the handling and processing of milk and dairy products. Two class hours, one 2-hour laboratory period. Mr. Hankinson.

666. **HYGIENIC PRINCIPLES OF FOOD HANDLING.**

Application of hygienic principles to the preparation, processing, and handling of foods, with emphasis on the training of supervisory personnel.

Credit, 4. Mr. Evans, Mr. Stumbo.

671. **ANALYSIS OF FOOD PRODUCTS.**

Physical, chemical, microbiological and microscopical methods.

Two class hours, one 4-hour laboratory period.

Prerequisite, analytical chemistry. Mr. Hunting.

672. **OBJECTIVE ANALYTICAL METHODS AND INSTRUMENTATION.**

Continuance of 671.

Two class hours, one 4-hour laboratory period.

Prerequisite, FS&T 671. Mr. Hunting.

680. **SPECIAL TOPICS IN WORLD FOOD TECHNOLOGY.**

Selected problems in applications of food technology to solution of world food problems in developing countries. Mr. Esselen.

684. **SENSORY EVALUATION METHODS.**

An introduction to sensory measurements in the evaluation and acceptance of foods. Panel tests and their statistical interpretation; taste, odor, color, and texture measurements.

One class hour, one 2-hour laboratory period.

Credit, 2. Mr. Sawyer.

COURSES NOT FOR MAJOR CREDIT

(No graduate credit for students majoring in Food Science and Technology)

551. **INTRODUCTORY FOOD SCIENCE.**

Food manufacture, processing, distribution and spoilage problems. Mr. Hayes.

575. **SURVEY OF FOOD TECHNOLOGY.**

Not open to department majors.

Two class hours, one 2-hour laboratory period.

Mr. Esselen, Mr. Hayes.

Forestry and Wood Technology

GRADUATE FACULTY

DONALD R. PROGULSKE, *Head of Department of Forestry and Wildlife Management*, B.S., University of Massachusetts, 1950; M.S., Virginia Polytechnic Institute, 1952; Ph.D., University of Missouri, 1956.

HAROLD B. GATSLICK, *Director of Graduate Studies in Wood Technology and Professor of Wood Technology*, B.S., State University of N.Y., College of Forestry, 1944; M.S., 1948; Ph.D., 1954.

DONALD L. MADER, *Director of Graduate Studies in Forestry and Professor of Forestry*, B.S., State University of N.Y., College of Forestry, 1950; M.S., Wisconsin, 1954; Ph.D., 1956.

HERSCHEL C. ABBOTT, *Professor of Forestry*, B.S., Maine, 1943; M.F., Harvard, 1952; M.A., 1959.

ROBERT S. BOND, *Associate Professor of Forestry*, B.S., Massachusetts, 1951; M.F., Yale, 1952; Ph.D., State University of N.Y., College of Forestry, 1966.

CARL A. CARLOZZI, *Associate Professor of Resource Planning*, B.S., Kent State, 1955; M.A., 1957; Ph.D., Michigan, 1965.

R. BRUCE HOADLEY, *Associate Professor of Wood Technology*, B.S., Connecticut, 1955; M.F., Yale, 1957; D.F., 1962.

WILLIAM P. MACCONNELL, *Professor of Forestry*, B.S., Massachusetts, 1943; M.F., Yale, 1948.

JOSEPH C. MAWSON, *Assistant Professor of Forestry*, B.S., Maine, 1956; M.F., Duke, 1958; M.A., California at Berkeley, 1966.

WILLIAM S. McNAMARA, *Assistant Professor of Wood Technology*, B.S., Massachusetts, 1962; M.S., Idaho, 1964; Ph.D., North Carolina State, 1968.

JOHN H. NOYES, *Professor of Forestry*, B.S., Connecticut, 1937; M.F., Yale, 1939.

BRIAN PAYNE, *Adjunct Assistant Professor of Forestry*, B.S., California at Berkeley, 1961; M.F., Duke, 1962; Ph.D., California at Berkeley, 1969.

ARNOLD D. RHODES, *Professor of Forestry*, B.S., New Hampshire, 1934; M.F., Yale, 1937.

WILLIAM W. RICE, *Associate Professor of Wood Technology*, B.S., University of Maine, 1948; M.F., Yale, 1949; D.F., Duke, 1964.

BRAYTON F. WILSON, *Associate Professor of Forestry*, B.A., Harvard, 1955; M.F., 1957; Ph.D., California at Berkeley, 1961.

Degrees offered are the Master of Science (with thesis and non-thesis options) and the Doctor of Philosophy.

Areas of program specialization include forest soils and ecology, physiology, silviculture, forest management, resource economics and planning, forest recreation, forest hydrology, wood science and technology, product development and processing, operations research, and marketing, with emphasis on structural elements, components, and systems for housing. Programs of instruction and related research in forestry place more than ordinary emphasis on urban-generated problems of land-use and environmental quality. Because of the interdisciplinary nature of these subjects, programs of study usually draw heavily upon courses in other departments, especially in Landscape Architecture.

Completion of a master's-level program requires from three to five semesters depending upon the student's background and educational objectives; and an additional two, or more likely, three years are needed to attain the doctorate. A reading knowledge of one or more foreign languages sufficient to understand journal material may be required of doctoral students in certain areas of specialization.

An applicant's undergraduate preparation preferably should have focused on forestry, wood science and technology, engineering, planning, or a closely related field in natural resource management, conservation, natural science, or social science and economics. Students from other backgrounds can be accommodated but longer-than-typical programs will be required to qualify for a degree which is normally based on a non-thesis program with a professional, rather than research, orientation. The non-thesis, professional approach is available for the more conventionally-prepared student also.

Applicants are required to take the Graduate Record Examination Aptitude Test.

ALL COURSES CARRY 3 CREDITS UNLESS OTHERWISE SPECIFIED

FORESTRY COURSES OPEN TO GRADUATE STUDENTS ONLY

(For either major or minor credit)

700. SPECIAL PROJECT.

Selected research problem in forestry not related to the candidate's thesis. *Credit, 2-4.*

701. ADVANCED FOREST SOILS.

The relation of soils to tree growth and other environmental factors with emphasis on research methods, site-evaluation, water relationships, and fertility; laboratory and field exercises.

Prerequisite, For 524 or equivalent.

Mr. Mader.

702. AERIAL PHOTO-INTERPRETATION.

Advanced aerial photo-interpretation emphasizing the analysis of natural vegetation, especially forest vegetation; a wide selection of aerial photographs is available for interpretive study and cartography.

Prerequisite, For 531 or equivalent.

Mr. MacConnell.

703. ADVANCED FOREST ECOLOGY.

Research methods and instrumentation in forest ecology; forest influences with emphasis on the effect of microclimate on site quality and the management of watersheds.

Prerequisite, For 523 or equivalent.

Mr. Mader.

704. ADVANCED SILVICULTURE.

Growth and reproductive characteristics and requirements of trees and forest stands as they affect silvicultural management, particularly in relation to thinning and the establishment of forest regeneration.

Prerequisites, For 523, 524, and 526, or equivalents.

Mr. Rhodes.

705. RESEARCH CONCEPTS IN FOREST BIOLOGY.

The development of biological knowledge relating to forestry from both the historical and philosophical points of view with emphasis on contributions of contemporary scientific research. Given in alternate years.

Mr. Abbott.

706. ADVANCED FOREST MENSURATION.

Regression analysis applied to stand and tree volume determination, stand growth and yield, forest site evaluation, and related measurement problems. Computer techniques used to solve some of the problems.

Prerequisites, For 525 and 534, or equivalents.

Mr. Mawson.

707. ADVANCED FOREST MANAGEMENT.

Economic evaluation of forest enterprises; appraisal of rates of return, damage, and stumpage values.

Prerequisite, For 540 or equivalent.

Mr. MacConnell.

708. MICROECONOMICS OF FORESTRY I.

Principles of microeconomics as applied to forestry problems with emphasis on marginal analysis in regard to land, labor, and capital.

Prerequisite, For 535 or equivalent.

Mr. Bond.

709. MICROECONOMICS OF FORESTRY II.

A continuation of Forestry 708 with emphasis on supply and demand, marketing, taxation, and social problems in relation to the forest economy.

Mr. Bond.

791, 792. SEMINAR.

Specialized study in a selected area of forestry.

Credit, 1-3.

800. MASTER'S THESIS.

Credit, 6-10.

900. DOCTORAL DISSERTATION.

Credit, 30.

FORESTRY COURSES OPEN TO BOTH GRADUATE AND UNDERGRADUATE STUDENTS

(For either major or minor credit)

522. CONSERVATION OF NATURAL RESOURCES. Conservation principles and their application to problems in soil, water, forests, wildlife, mineral, and general landscape resources; relationship of conservation to national development.

523. SILVICS (ECOLOGY AND GROWTH OF TREES).

Forest ecology and tree growth as a foundation for silviculture and other uses of the forest; interactions of environment and forests; development and classification of forest communities.

Credit, 4. Mr. Mader, Mr. Wilson.

524. FOREST SOILS.

Effects of soil properties on tree growth; relationship of soils to silviculture, harvesting, watersheds, wildlife, and range management; forest soil description, classification, and mapping.

Mr. Mader.

525. THE ELEMENTS OF FOREST MENSURATION.

The measurement of trees, stands, and forest products; field and office practice in timber-estimating and log-scaling; collection and compilation of forest inventory data.

Mr. Mawson.

526. THE PRINCIPLES OF SILVICULTURE.

Forest culture of wood crops; regeneration and intermediate cuttings, silvicides, prescribed burning, site-treatment, slash disposal, nursery management, forest planting and direct seeding; interactions with management for water, wildlife, recreation, and esthetics.

For 523 recommended.

Credit, 4. Mr. Rhodes, Mr. Abbott.

527. TREE PHYSIOLOGY.

Growth and development during the life cycle of trees, emphasizing the whole-plant approach and phenomena best-studied in trees; the physiological basis of silviculture.

Prerequisite, Botany 211 or equivalent.

Mr. Wilson.

528. FOREST HYDROLOGY.

Principles and factors controlling the hydrologic cycle on forest lands. Review of forest watershed management research on the influence of soils, vegetation, and management practices on water yields and water quality. Watershed management as a part of integrated forest land management.

Mr. Mader.

529. FOREST PROTECTION.

Principles of protecting forests from fire, insects, diseases, domestic animals, wildlife, and atmospheric agencies with emphasis on the prevention and control of forest fires.

Mr. Abbott.

531. AERIAL PHOTOGRAMMETRY.

Principles of photogrammetry in forest management, wildlife biology, and other fields concerned with large land surfaces. Photographic interpretation and map-making from aerial photographs.

Mr. MacConnell.

532. FOREST-TREE IMPROVEMENT.

Tree introduction, geographic variation, tree selection, vegetative propagation, controlled pollination and hybridization, seed-orchard management.

Mr. Abbott.

534. FOREST SURVEY AND SAMPLING DESIGN.

The theory and application of sampling techniques in forest survey and research problems including simple random, stratified, subsampling, representative, and probability sampling.

Mr. Mawson.

535. FOREST ECONOMICS.

The application of economic principles to the allocation of land, labor, and capital in forest enterprises; market and pricing theory of forest products.

Prerequisite, introductory economics.

Mr. Bond.

536. FOREST RESOURCES POLICY.

Forest policy in the United States; history of policy development; factors affecting forest resources management; forest taxation, credit, insurance, and resource planning.

Mr. Bond.

539. THE FOREST RESOURCES OF NORTH AMERICA.

The forest resources of North America and their management for multi-purpose economic and social benefits; regional physiography, climate, vegetation, demography, and economic base; environmental, economic, and socio-political constraints affecting management.

Prerequisite, natural resource, regional-planning, or similar backgrounds recommended.

Mr. Rhodes.

540. PRINCIPLES OF FOREST MANAGEMENT.

Multiple-use management of forest land; organization of the forest for sustained-yield management; preparation of a management plan for a 10,000-acre forest.

Laboratory period optional for non-forestry majors.

Prerequisite for the laboratory, For 525.

Credit, 3 or 5. Mr. MacConnell.

602. ECOLOGICAL PRINCIPLES IN RESOURCE PLANNING.

Analysis of ecological principles and their relationship and importance to resource planning. State and federal conservation programs chosen for critical case study.

Prerequisite, permission of instructor.

Mr. Carlozzi.

WOOD TECHNOLOGY COURSES OPEN TO GRADUATE STUDENTS ONLY

(For either major or minor credit)

700. SPECIAL PROJECT.

Selected research problem in wood technology not related to the candidate's thesis.

Credit, 2-4.

710. CHEMICAL MODIFICATION OF WOOD.

Basic concepts and techniques concerning the chemical modification of wood; the potential and limitations of physical and chemical treatments as they affect the dimensional stability and durability of wood.

Prerequisites, organic chemistry and Wood Tech 504.

Mr. Gatslick.

711. POLYSACCHARIDE AND LIGNIN CHEMISTRY.

The chemistry and biochemistry of lignin, and of plant polysaccharides with special reference to gums, pectins, hemicelluloses, and cellulose.

Prerequisites, organic chemistry, Wood Tech 538, or equivalent.

Mr. McNamara.

791, 792. SEMINAR.

Specialized study in a selected segment of wood-products marketing or wood technology.

Credit, 1-3 each semester.

800 MASTER'S THESIS.

Credit, 6-10.

900. DOCTORAL DISSERTATION.

Credit, 30.

WOOD TECHNOLOGY COURSES OPEN TO BOTH GRADUATE AND UNDERGRADUATE STUDENTS

(For either major or minor credit)

501. WOOD ANATOMY AND IDENTIFICATION.

A basic anatomical study of wood elements, their structural characteristics and function; identification of woods.

Mr. Hoadley.

502. PRIMARY TIMBER CONVERSION.

Survey of operations, principally sawmilling, in primary conversion of logs into lumber and allied byproducts; drying, grading, handling, and market distribution of sawmill products. Not open to students in forest management except by special permission.

Mr. Rice.

503. FOREST PRODUCTS.

A survey of the principal forest products, their manufacture and distribution.

Mr. Gatslick.

504. PROPERTIES OF WOOD.

The physical and chemical characteristics of wood in relation to its use; the influence of growth upon wood properties; methods of testing.

Mr. Hoadley.

506. WOOD MACHINING TECHNOLOGY.

Fundamental principles of knife and sawtooth action as applied to problems of severing, surfacing, and shaping; general survey of commercial wood-machining equipment.

Prerequisites, Wood Tech 501 and 504.

Mr. Rice.

508. WOOD SEASONING AND PRESERVATION.

Properties of wood in relation to drying and preservation; theory and practice of air seasoning, kiln drying, and preservative treatment.

Mr. Rice.

511. WOOD ADHESIVE TECHNOLOGY.

Basic concepts, theories, and the applied techniques of gluing wood and fibrous composites.

Prerequisites, Wood Tech 501, 504, and organic chemistry; or permission of instructor.

Mr. McNamara.

512. WOOD COATING TECHNOLOGY.

Basic concepts and applied techniques in wood substrate surface modification including materials and methods for finishing wood and fibrous composites.

Prerequisites, Wood Tech 501, 504, and organic chemistry; or permission of instructor.

Mr. Gatslick.

538. WOOD CHEMISTRY.

Introduction to the chemistry and surface phenomena of the principal products found in wood.

Prerequisite, organic chemistry.

Mr. McNamara.

French

GRADUATE FACULTY

BENJAMIN ROUNTREE, *Acting Director of Graduate Studies in French and Associate Professor*, B.A., Georgia, 1953; M.A., 1955; Ph.D., Yale, 1960.

MICHELINE DUFAU, *Chairman of the Department of French and Italian and Professor of French*, B.-ès-L., Paris, 1945; B.S., New York University, 1951; Ph.D., 1960.

MIREILLE M. L. AZIBERT, *Assistant Professor*, B.-ès-L., Bordeaux, 1941; L.-ès-L., Paris, 1949; D.E.S.C., Bordeaux, 1951; Ph.D., Pennsylvania, 1969.

JOHN P. BERWALD, *Assistant Professor*, B.A., Michigan, 1956; M.A., Middlebury, 1964; Ph.D., Ohio State, 1971.

FREDERICK A. BUSI, *Associate Professor*, B.A., American International College, 1960; M.A., Connecticut, 1963; Ph.D., 1965.

MARIE-ROSE CARRE, *Associate Professor*, B.-ès-L., Alger, 1938; L.-ès-L., 1940; D. de l'U., Paris, 1963.

THOMAS CASSIRER, *Professor*, B.A., McGill, 1945; Ph.D., Yale, 1953.

URSULA F. CHEN, *Assistant Professor*, B.A., Cologne, 1950; M.A., Cornell, 1958; Ph.D., 1968.

CHRISTIAN CARAUD, *Assistant Professor*, B.-ès-L., Poitiers, 1954; L.-ès-L., 1958; D. de 3^e cycle, 1961 (in Classics); D. de 3^e cycle, 1969 (in French).

WILLIAM V. GUGLI, *Assistant Professor*, B.A., Brown, 1954; B.S.F.S., Georgetown, 1955; M.A., Brown, 1959; Ph.D., Syracuse, 1967.

AGNES G. RAYMOND (HOWARD), *Associate Professor*, B.A., Wilson College, 1937; M.A., Syracuse, 1945; D.M.L., Middlebury, 1956.

PATRICIA J. JOHNSON, *Associate Professor*, B.A., Minnesota, 1953; M.A., 1956; Ph.D., 1960.

ROBERT B. JOHNSON, *Professor*, B.A., Ohio, 1940; M.A., Wisconsin, 1946; Ph.D., 1949.

NANCY E. LAMB, *Assistant Professor*, B.A., Mt. Holyoke, 1959; M.A. (French), Middlebury, 1960; M.A. (Spanish), Middlebury, 1964; D.M.L., Middlebury, 1971.

SARAH N. LAWALL, *Associate Professor*, B.A., Oberlin, 1956; Ph.D., Yale, 1961.

PAUL A. MANKIN, *Associate Professor*, B.A., California at Los Angeles, 1948; M.A., 1953; Ph.D., Yale, 1959.

ELAINE MARKS, *Professor*, B.A., Bryn Mawr, 1952; M.A., University of Pennsylvania, 1953; Ph.D., New York University, 1958.

DAVID O'CONNELL, *Assistant Professor*, B.A., St. Peter's College, 1962; M.A., Princeton, 1964; Ph.D., 1966.

DENNIS D. PORTER, *Associate Professor*, B.A., Cambridge, 1957; Ph.D., California at Berkeley, 1966.

HAROLD L. SMITH, JR., *Associate Professor*, B.-ès-L., Paris, 1940; B.A., Swarthmore, 1947; M.A., Columbia, 1950; Ph.D., Wisconsin, 1955.

SARA STURM, *Associate Professor of French and Italian*, B.A., Minnesota, 1963; M.A., 1965; Ph.D., North Carolina, 1967.

ROBERT E. TAYLOR, *Professor*, B.A., Reed College, 1943; M.A., Columbia, 1947; Ph.D., 1951.

SEYMOUR S. WEINER, *Professor*, B.A., City College of New York, 1940; M.A., California at Berkeley, 1941; Ph.D., Columbia, 1950.

ASSOCIATED FIVE-COLLEGE GRADUATE FACULTY

WILLIAM S. BELL, *Associate Professor of French* (Mount Holyoke College), B.A., Howard, 1942; B.M., Birmingham Conservatory of Music, 1948; M.A., Middlebury, 1949; Ph.D., Columbia, 1960.

JEFFREY J. CARRE, *Professor of Romance Languages* (Amherst College), B.A., Bowdoin, 1940; M.A., Columbia, 1941; Ph.D., 1951.

MARJORIE FITZPATRICK, *Assistant Professor* (Smith College), B.A., College of Our Lady of the Elms, 1957; M.A., Smith, 1959; Ph.D., University of Toronto, 1968.

ELMO GIORDANETTI, *Professor* (Amherst College), B.A., Bowdoin, 1951; M.A., Princeton, 1954; Ph.D., Princeton, 1959.

JACQUES-HENRI PÉRIVIER, *Associate Professor*, (Mount Holyoke College), Baccalaureate, St. Joseph, Poitiers, France, 1950; Licence en Droit, University of Paris Law School, 1955; M.A., Pennsylvania, 1961; Ph.D., 1965.

MARGARET L. SWITTEN, *Professor*, (Mount Holyoke College), B.M., Westminster Choir College, 1947; B.A., Barnard, 1948; M.A., Bryn Mawr, 1949; Ph.D., Bryn Mawr, 1952.

COURSE REQUIREMENTS FOR THE MASTER OF ARTS DEGREE

1. French 709 (Bibliography and Methods) or an equivalent course.
2. French 800 may be elected for 6 credits.
3. Terminal examination as follows:
 - a. Comprehensive oral examination.
 - b. For those presenting a thesis, the period covered in the thesis is not to be included in the comprehensive oral examination.

THE MASTER OF ARTS IN TEACHING DEGREE

The Department of French and Italian in cooperation with the School of Education offer a program of studies in French language and literature and professional preparation in teaching leading to the degree of Master of Arts in Teaching. A total of 36 semester hours are required for the degree, of which 12 will be in French language and literature, 12 in professional preparation, and 12 in electives from both of these areas of study. Each program will be arranged to suit the needs and background of individual candidates. Courses specifically for the teacher of French include the following:

1. Introductory and advanced methods of teaching French at the secondary level.
2. Applied Linguistics.
3. Foreign Language Research.
4. Intern teaching.
5. Practicums in teaching, Individualized instruction and educational technology.
6. Independent study courses of directed readings.

Candidates entering the program are expected to be fluent in all aspects of the language. Undergraduate work should have been undertaken in phonetics, advanced grammar, composition, and literature. Students deficient in French grammar or phonetics may do remedial work in these areas once admitted to the program, but such work may not be counted towards the degree. Scores of the Graduate Record Examination are required by the Department. Students transferring from other institutions may be granted up to 6 semester hours towards the M.A.T. Those who have completed state certification requirements will also be eligible for the M.A.T.

THE FIVE COLLEGE COOPERATIVE Ph.D. PROGRAM. In addition to the general requirements for the degree at the University, the following special requirements must be met:

1. Required courses:
 - a. One semester of Romance Philology or its equivalent.
 - b. One semester of Old French or its equivalent.

- c. French 709 (Bibliography and Methods) or the equivalent knowledge.
- d. French 900, Doctoral Dissertation.
2. A reading-knowledge at an intermediate or advanced level (as determined by the Department) of two languages pertinent to the student's program, other than English and French.
3. Candidates planning to write a thesis in the medieval or Renaissance field must present Latin as one of their languages.
4. Competence in teaching French.
5. An oral examination as part of the preliminary comprehensive examination, demonstrating proficiency in the language itself, a knowledge of the whole body of French literature and of the history of the language, a thorough knowledge of the candidate's special field, evidence of knowledge of the history and the culture of the country or countries involved.

3-FIGURE COURSE NUMBERING SYSTEM

Intermediate figure: Terminal figure:

- | | |
|------------------------|----------------------------|
| 1 Middle Ages, 16th C. | 1, 2, 3 general |
| 2 17th C. | |
| 3 18th C. | |
| 4 19th C. | 4 plural genres, centuries |
| | 5, 6 novel |
| 5 20th C. | |
| 6 language | |
| 7 general | 7, 8 poetry |
| 8 special problems | |
| 9 seminars | 9 theater |

ALL COURSES CARRY 3 CREDITS UNLESS OTHERWISE SPECIFIED

COURSES OPEN TO GRADUATE STUDENTS ONLY

410. GRADUATE READING COURSE (formerly 409).

For graduate students in other departments preparing for their M.A. or Ph.D. reading examination. No previous knowledge of French required. *No credit.*

700. SPECIAL PROBLEMS.

Directed study in some phase of linguistics or literature.

701 (I), 702 (II). THE CRAFT OF FICTION IN THE 19TH CENTURY (formerly 790, 791).

The exploration of different modes in the treatment of realism through a study of the craft of fiction of individual novelists.

Credit, 3 each semester. Mr. Smith, Mr. Weiner.

711. OLD FRENCH READINGS (formerly 719).

The monuments of French literature from the earliest times to the 15th century. Miss Dufau.

712. RABELAIS AND MONTAIGNE (formerly 721).

The changing ideas in the French Renaissance. Miss Azibert.

715. THE "ROMAN COURTOIS."

Emphasis on Chrétien de Troyes and his successors.

Prerequisite, French 710 or equivalent.

Miss Dufau, Mrs. Sturm.

717. MEDIEVAL EPIC POETRY.

Some of the outstanding chansons de geste and the development of the cycles of epic poetry.

Prerequisite, French 710 or equivalent.

Mrs. Sturm.

718. PLÉIADE, "ÉCOLE LYONNAISE" (formerly 737).

Emphasis on the Pléiade from the background of the "grands rhétoriciens," Marot and the "école lyonnaise." Miss Azibert.

719. THE MEDIEVAL THEATER (formerly 713).

The principal dramatic forms from the 12th through the 15th century.

Prerequisite, French 710 or equivalent.

Miss Dufau.

720. SEVENTEENTH-CENTURY "LIBERTINAGE" (formerly 730).

Aspects of the history of thought from Montaigne to Pierre Bayle.

Mr. Taylor.

721. LAFONTAINE AND HIS TIMES (formerly 737).

Mr. Garand.

722. MOLIERE (formerly 733).

The man and the dramatist, his ideas and his techniques.

Mr. Taylor, Mr. Rountree.

723. RACINE (formerly 734).

A detailed analysis of the major and minor plays as drama and as poetry.

Mr. Rountree, Mrs. Carre.

731. VOLTAIRE AND HIS TIMES (formerly 741).

Mr. Taylor.

732. MONTESQUIEU AND HIS TIMES (formerly 742).

Mrs. Raymond.

733. DIDEROT (formerly 749).

The original thinker and compiler.

Mr. Taylor.

760. COURS DE STYLE (formerly 672).

Syntax and idiom at an advanced level.

Mr. Smith, Mrs. Carre.

761. ROMANCE PHILOLOGY AND THE HISTORY OF THE FRENCH LANGUAGE (formerly 710).

The development of the Romance languages, particularly French, from Vulgar Latin.

Mrs. Chen.

762. PROVENÇAL PHILOLOGY (formerly 711).

Provençal or some other language particularly; see Department announcements.

Mrs. Chen, Mrs. Sturm.

770. BIBLIOGRAPHY AND METHODS OF LITERARY RESEARCH (formerly 709).

Required of candidates for the degrees of Master of Arts and Doctor of Philosophy.

Mr. Taylor, Mr. Weiner.

799. SEMINARS (formerly 795-799).

Credit, 3 each semester. Maximum credit, 12.

800. MASTER'S THESIS.

Credit, 6.

801. LITERARY CRITICISM: NINETEENTH CENTURY (formerly 880).

Development of criticism from Sainte-Beuve.

Mr. Weiner.

802. LITERARY CRITICISM: 20TH CENTURY (formerly 881).

Critical tenets and practices in the twentieth century. Readings and discussions of, for example, Thibaudet, Bachelard, Paulhan, Sartre.

Mr. Weiner.

845. BALZAC AND STENDHAL (formerly 855).

Mr. Weiner, Mr. Porter.

846. FLAUBERT AND ZOLA (formerly 856).

The assimilation of the "mouvement des idées" of the period within the fictional worlds of the two novelists.

Mr. Smith, Mr. Porter.

848. BAUDELAIRE AND THE SYMBOLISTS (formerly 858).

Emphasis on the esthetics and poetics of Baudelaire alone; his work as an introduction to the gamut of symbolist poetry.

Mr. Johnson.

853. THE ANTI-NOVEL AND ANTI-THEATER (formerly 869).

The reaction against established literary form and conventions in the novels of such authors as Sarraute, Robbe-Grillet, Butor, and Simon, and in the plays of such authors as Ionesco and Adamov. Mrs. Johnson.

854. CAMUS AND SARTRE (formerly 860).

The novels, short stories, plays, and philosophical essays. Mrs. Johnson.

855. PROUST AND GIDE (formerly 865).

Detailed analysis of parts of *A la recherche du temps perdu* and representative works of Gide's fiction. Mr. Mankin.

859. CLAUDEL AND GIRAUDOUX. (formerly 863).

Their contribution to the literary theater of the 20th century as seen through a study of esthetic and moral values. Mrs. Raymond, Mr. Mankin.

900. DOCTORAL DISSERTATION. Credit, 30.

COURSES OPEN TO BOTH GRADUATE AND UNDERGRADUATE STUDENTS

561. ADVANCED GRAMMAR (formerly 570).

Mrs. Chen, Mrs. Carre, Mr. Rountree.

562. THE THEORY AND ART OF TRANSLATION. The practical and theoretical problems arising in translation.

571. CIVILIZATION OF FRANCE (formerly 690).

Those elements which underlie the cultural contribution to world civilization. Assigned reading drawn from contemporary French literature.

Mr. Mankin, Mr. O'Connell.

601, 602. LITERARY MOVEMENTS

(formerly 681, 682).

Characteristics and definitions of a selected movement or period (e.g., Baroque, Romanticism).

Credit, 3 each semester.

603. EXPLICATION DE TEXTES (formerly 683).

The principles of textual analyses and practice in that exercise. Required of students in Teacher Training.

Miss Dufau, Mrs. Carre, Mr. Cassirer.

604. THE ART OF LITERATURE (formerly 684).

The structures of literary works of art; emphasis on the esthetic. The genres vary; see Department announcement.

614. RENAISSANCE PROSE (formerly 621).

Major French prose writers of the 16th century.

Miss Azibert.

617. RENAISSANCE POETRY (formerly 620).

Representative poets of the 16th century. Emphasis on the Pléiade.

Miss Azibert.

621. 17TH-CENTURY COMIC VISION

(formerly 632).

Emphasis on Molière, La Fontaine, and La Bruyère.

Mr. Garaud, Mr. Rountree.

622. 17TH-CENTURY TRAGIC VISION

(formerly 633).

The classical tragic vision in the theater and the novel as represented by Corneille, Racine, and Mme de La Fayette.

Mrs. Carre, Mr. Rountree.

624. 17TH-CENTURY PHILOSOPHERS AND MORALISTS (formerly 631).

The writers most important in classical thought, especially Descartes, Pascal, and LaRocheffoucauld.

Mr. Garaud.

634. 18TH-CENTURY LITERATURE (formerly 640).

The chief writers and thinkers of the Age of Enlightenment.

Mrs. Raymond, Mr. Taylor.

635. 18TH-CENTURY NOVEL (formerly 645).

The satirical novel as represented by LeSage, Montesquieu, Voltaire, and Diderot; the sentimental novel as

represented by Prévost, Marivaux, Rousseau, Bernardin de Saint-Pierre. Mr. Taylor.

639. 18TH-CENTURY THEATER (formerly 643).

Readings in the French theater from LeSage to Beaumarchais. Mrs. Raymond.

640. 19TH-CENTURY POETRY: THEMES

(formerly 651).

Themes vary; see Department announcement.

Mr. Gugli, Mr. Johnson, Mrs. Lawall, Mr. Weiner.

644. 19TH-CENTURY POETRY: NERVAL AND

THE PARNASSIANS (formerly 658).

The development of poetry between Romanticism and symbolism. Mrs. Lawall, Mr. Gugli.

645. 19TH-CENTURY ROMANTIC NOVEL

(formerly 655).

The development of the novel from the Revolution to mid-century: Constant, Chateaubriand, Balzac, Hugo, Dumas, Stendhal. Mr. Smith, Mr. Busi, Mr. Porter.

646. 19TH-CENTURY REALISTIC-NATURALISTIC

NOVEL (formerly 656).

The novel of the second half of the century, from Flaubert to Zola. Mr. Smith, Mr. Weiner, Mr. Busi.

647. 19TH-CENTURY ROMANTIC POETRY

(formerly 657).

The major movements in poetry from Chénier to Baudelaire. Mr. Gugli, Mr. Weiner.

648. 19TH-CENTURY SYMBOLIST POETRY

(formerly 659).

Baudelaire, Rimbaud, Mallarmé, Verlaine. Mr. Johnson.

649. 19TH-CENTURY THEATER (formerly 653).

The development of the theater from Hugo to Rostand and his contemporaries. Mr. Weiner.

654. FRENCH-AFRICAN AND CARIBBEAN

LITERATURE (formerly 669).

Mr. Cassirer.

655 (I), 656 (II). 20TH-CENTURY NOVEL

(formerly 665, 666).

The novel of social concern, the novel of personal and esthetic concern, and the novel concerned with the human condition, tradition, and innovation.

Credit, 3 each semester. Mr. Weiner, Mr. Mankin,

Mrs. Johnson, Mr. O'Connell.

657. 20TH-CENTURY POETRY I (formerly 667).

Major French poets from the turn of the century to surrealism: Valéry, Apollinaire, Claudel, Reverdy, Eluard, Desnos, Cendrars and the beginning of surrealism with the first manifesto of 1924. Mrs. Lawall, Mr. Johnson.

658. 20TH-CENTURY POETRY II (formerly 668).

French poetry from surrealism to the present: Breton, Char, Michaux, Perse, Ponge, Bonnefoy, and selected contemporaries. Surrealism as a movement in itself and as a precursor of more recent poetry.

Mr. Johnson, Mrs. Lawall, Mrs. Carre.

659. 20TH-CENTURY THEATER (formerly 663).

The main currents of modern French theater from symbolism to the theater of the absurd as seen in about fifteen representative plays. Mr. Mankin, Mrs. Raymond.

661. APPLIED LINGUISTICS (FRENCH)

(formerly 679).

French linguistics applied to the teaching of French in secondary schools. Mrs. Chen, Mr. Berwald.

662. METHODS OF TEACHING FRENCH

(formerly 671).

Teaching methods. Recommended for those intending to teach French in high schools or elementary schools.

Mr. Berwald.

663. TEACHING METHODS FOR INTERMEDIATE AND ADVANCED FRENCH.

The teaching of Intermediate and Advanced French. Continuation of Educ 307. Mr. Berwald.

674. FRENCH-CANADIAN LITERATURE.

Contemporary Canadian poets, novelists, and dramatists writing in French. Miss Allard.

Geology and Geography

GRADUATE FACULTY

JOSEPH H. HARTSHORN, *Head of the Department of Geology and Geography and Professor, B.S., Harvard, 1947; M.A., 1950; Ph.D., 1955.*

R. W. BROMERY, *Chancellor of the University and Professor, B.S., Howard, 1956; M.S., American University, 1962; Ph.D., Johns Hopkins, 1968.*

D. O. DOEHRING, *Assistant Professor, B.A., University of California (Berkeley), 1962; M.A., Claremont-Pomona, 1965; Ph.D., Wyoming, 1968.*

OSWALD C. FARQUHAR, *Professor, B.A., Oxford, 1947; M.A., 1948; Ph.D., Aberdeen, 1951.*

STEPHEN E. HAGGERTY, *Assistant Professor, B.S., London Univerity, Imperial College of Science and Technology, 1964; Ph.D., 1968.*

LEO M. HALL, *Associate Professor, B.S., St. Lawrence, 1954; M.S., Cincinnati, 1956; Ph.D., Harvard, 1959.*

JOHN F. HUBERT, *Professor, B.A., Harvard, 1952; M.S., Colorado, 1954; Ph.D., Pennsylvania State University, 1958.*

HOWARD W. JAFFE, *Professor, B.A., Brooklyn College, 1942; D. Sc., University of Geneva.*

GEORGE E. MCGILL, *Associate Professor, B.A., Carleton College, 1953; M.S., Minnesota, 1955; Ph.D., Princeton, 1958.*

STEARNS A. MORSE, *Associate Professor, B.A., Dartmouth, 1952; M.S., McGill, 1958; Ph.D., 1962.*

WARD S. MOTTS, *Associate Professor, B.A., Columbia, 1949; M.S., Minnesota, 1951; Ph.D., Illinois, 1957.*

ALAN W. NIEDORODA, *Assistant Professor, B.A., Queens College, CUNY, 1966; M.S., Florida State University, 1968; Ph.D., 1972.*

EDWARD A. PERRY, JR., *Assistant Professor, B.A., Dartmouth, 1964; Ph.D., Case Western Reserve University, 1969.*

CHARLES W. PITRAT, *Associate Professor, B.A., Kansas, 1949; M.S., Wisconsin, 1951; Ph.D., 1953.*

PETER ROBINSON, *Associate Professor, B.A., Dartmouth, 1954; M.S., Otago University, New Zealand, 1958; Ph.D., Harvard, 1964.*

H. T. U. SMITH, *Professor, B.S., Wooster College, 1930; M.A., Harvard, 1933; Ph.D., 1936.*

GREGORY W. WEBB, *Professor, B.A., Columbia, 1948; M.A., 1950; Ph.D., 1954.*

DONALD U. WISE, *Professor, B.S., Franklin and Marshall College, 1953; M.S., California Institue of Technology, 1955; Ph.D., Princeton, 1957.*

REQUIREMENTS FOR THE DOCTOR OF PHILOSOPHY DEGREE

Ordinarily the doctoral candidate is assumed to have received the master's degree or equivalent training; selected students with outstanding records may proceed more directly toward meeting doctoral requirements.

Candidates must fulfill the general Graduate School requirements in addition to the following:

1. Basic training in physics, chemistry, and mathematics.
 2. At least four months of training and experience in field geology.
 3. A broad knowledge of fundamental concepts, methods of investigation, and historical development of geologic science.
 4. Reading-knowledge of two foreign languages sufficient to understand journal material or reading-knowledge of one foreign language and fulfillment of departmental computer-science requirement.
 5. Mastery of four elected fields of specialization, three of which must be in geology.
 6. A thesis representing an original contribution to geologic knowledge.
 7. A final examination in defense of the thesis.
- Full details may be found in departmental announcement.

REQUIREMENTS FOR THE MASTER OF SCIENCE DEGREE

Each M.S. degree candidate has the option to complete the degree requirements by following a general degree program or a thesis degree program. The general degree program is designed for the student who wishes to develop a strong, broadly-based knowledge of geology. The thesis degree program is specialized and is designed for the student who has a specific interest in a given aspect of geology. A summary of the requirements included in the M.S. degree programs follows (T=thesis degree requirements; G=general degree requirement):

1. Sixty credits in geology, including both undergraduate and graduate work (T, G).
2. Thirty graduate credits, of which 21 credits must be in geology; the remaining 9 credits may be in geology or related fields (T, G).
3. At least 12 credits in geology, exclusive of Geology 790, must be in courses numbered 700 or higher (G); at least 6 credits in geology, exclusive of thesis and Geology 790, must be in courses numbered 700 or higher (T).
4. A full-year course in two of the following: biology, chemistry, or physics (T, G).
5. Mathematics through calculus (T, G).
6. Six weeks of field training (T, G).
7. Diagnostic examination (T, G).
8. Regional geology (G).
9. Final written and oral examination on seven basic fields of geology and two other fields, at least one of which is an applied field of geology (G).
10. Thesis proposal examination (T).
11. Preparation of thesis (T).
12. Thesis defense (T).

**ALL COURSES CARRY 3 CREDITS UNLESS
OTHERWISE SPECIFIED**

COURSES OPEN TO GRADUATE STUDENTS ONLY

(For either major or minor credit)

700. SPECIAL PROBLEMS.

Either or both of the following options may be selected:
A. Independent study—guided reading and/or laboratory study in subjects or techniques not covered by other courses in the department.

B. Research—original library, field, and/or laboratory investigation of a selected problem.

Prerequisites, 45 credits in geology and permission of Department Head and instructor. *Credit, 2-6.*

712. ADVANCED MINERALOGY.

Crystal chemistry, structure, and composition of minerals; interpretation, evaluation, and calculation of mineralogical data; precise measurement of mineralogical constants by optical microscopy, x-ray diffraction, and other methods.

Offered fall semester.

Prerequisite, Geol 611 or permission of instructor.

Mr. Jaffe or Mr. Morse.

713. CLAY MINERALOGY.

Structure of clay minerals, identification, weathering, and alteration of minerals, properties of clay surfaces, geotechnical studies of clays in geology, soil science, and soil mechanics.

Prerequisite, permission of instructor.

Mr. Jaffe or Mr. Perry.

716. GEOCHEMISTRY.

Abundance relations and principles governing the distribution, behavior, and migration of the elements and nuclides in the geochemical spheres of the earth, in meteorites, and in the universe.

Offered spring semester.

Prerequisites, Geol 192 and 520 and one year of college chemistry, or permission of instructor. *Mr. Jaffe.*

722. IGNEOUS PETROLOGY.

Introduction to phase equilibrium in mineral systems, with emphasis on liquidus relationships. Review of theoretical and experimental data and of natural occurrences and their bearing on problems of rock genesis.

Offered fall semester.

Prerequisite, Geol 621 or permission of instructor.

Mr. Morse.

723. SEDIMENTARY PETROLOGY.

Analysis and origin of primary sedimentary structures; petrology of sandstones; heavy-mineral analysis and interpretation. Petrology of carbonate rocks. Field applications emphasized.

Offered spring semester.

Prerequisites, Geol 550 and 611.

Mr. Hubert.

724. METAMORPHIC PETROLOGY.

Introduction to phase equilibrium in mineral systems with emphasis on metamorphic reactions. Review of theoretical and experimental data and natural occurrence and their bearing on metamorphic processes and on the mapping of metamorphic mineral facies.

Offered fall semester.

Prerequisite, Geol 621 or permission of instructor.

Mr. Robinson.

**731. STRUCTURAL GEOLOGY OF
METAMORPHIC ROCKS.**

Analysis of the geometry of intensely deformed rocks with emphasis on interpretation of structural features in the field.

Offered fall semester.

Prerequisite, Geol 531 or equivalent.

Mr. Hall.

732. ADVANCED STRUCTURAL GEOLOGY.

Dynamics and mechanics of rock deformation, including

theoretical and experimental studies, with field applications.

Offered spring semester.

Prerequisites, Geol 531 and calculus.

Mr. McGill.

735. REGIONAL GEOLOGY OF NORTH AMERICA.
Tectonic concepts as exemplified by the stratigraphic and structural evolution of North America.

Offered spring semester.

Prerequisite, Geol 530.

Mr. Wise, Mr. McGill.

741. STRATIGRAPHIC PALEONTOLOGY.

Application of selected fossils and faunal assemblages to stratigraphic correlation, and paleoecological and paleogeographic analysis, with reference to evolutionary trends.

Offered spring semester.

Prerequisites, Geol 540 and 551.

Mr. Pitrat.

745. PALEOECOLOGY.

Application of ecological principles to the interpretation of fossil animal and plant communities as indicators of depositional environments. Emphasis on marine faunas.

Offered spring semester.

Prerequisites, Geol 540 and 551. *Credit, 2.* Mr. Pitrat.

747. PALEOGEOGRAPHIC ANALYSIS.

Methods of paleogeographic analysis and mapping, including problems in stratigraphic synthesis, basin analysis, and paleogeologic and palinspastic mapping.

Offered spring semester.

Prerequisites, Geol 531, 540, and 550.

Mr. Webb.

751. SEDIMENTATION.

Analysis of the modes of origin of sedimentary rocks, with special reference to mudrocks, carbonates, and chemical sediments.

Offered fall semester.

Prerequisites, Geol 550 and 611.

Mr. Hubert.

752. GEOLOGICAL OCEANOGRAPHY.

Physical characteristics and geological processes of the ocean basins and margins, and their bearing on interpretation of geologic history.

Offered spring semester.

Prerequisites, Geol 550 and 666.

Mr. Webb.

756. COASTAL PROCESSES.

Sedimentologic and hydrographic processes of coastal environments and their relation to shoreline morphology and sediment transport and deposition. Emphasis on field studies of the estuaries and beaches along the New England shoreline.

Prerequisites, Geol 550 and 660, or permission of instructor. *Credit, 2.*

761. MAP INTERPRETATION.

A laboratory study of the various types of maps used by geologists, with special reference to the identification and interpretation of landforms and structures.

Offered fall semester.

Prerequisite, Geol 530.

Credit, 2. Mr. Smith.

762. ADVANCED GEOMORPHOLOGY.

A critical study of selected topics and current problems in geomorphology.

Offered spring semester.

Prerequisite, Geol 660.

Credit, 2. Mr. Smith.

769. ADVANCED PHOTOGEOLOGY.

A laboratory area of selected problems, areas, and techniques. Some emphasis on the use of surface expression as a key to subsurface phenomena.

Offered fall semester.

Prerequisites, Geol 660 and 668. *Credit, 2.* Mr. Smith.

771. PHYSICS OF THE EARTH.

Introduction to the physics of the earth as determined

from seismological, heat flow, gravity, and paleomagnetic data and their relationship to observed geological phenomena.

Offered fall semester.

Prerequisites, Geol 670 and permission of instructor.

Mr. Bromery.

772. ADVANCED GEOPHYSICAL INTERPRETATION TECHNIQUES.

Numerical and graphical analyses of air-borne and ground geophysical surveys, including the use of digital computer programs, and geologically meaningful interpretations.

Offered spring semester.

Prerequisites, Geol 670 and permission of instructor.

Mr. Bromery.

781. GEOLOGY IN ENGINEERING.

Relation of geologic materials, processes, forms, and techniques to the planning and execution of engineering projects, such as river control, shoreline protection, and construction of highways, bridges, tunnels, dams, etc. Emphasis is on case histories.

Offered spring semester.

Prerequisites, Geol 520, 530, 550, and 660, or permission of instructor; Civ Eng 520 and/or other engineering courses recommended. *Credit, 2.* Mr. Farquhar.

782. PETROLEUM GEOLOGY.

Geologic occurrence of oil and gas. Laboratory work consists of problems related to reservoir and trap conditions and to methods of subsurface study.

Offered fall semester.

Prerequisites, Geol 530 and 550; 735 desirable.

Mr. Webb.

783. METALLIFEROUS ECONOMIC GEOLOGY.

Nature, origin, and distribution of metalliferous ores. Criteria for recognition of ore deposits, changes in character of ore with depth, mineral associations, and types of wallrock alteration. Optical and microchemical properties of ore minerals and ore concentrates. Given in alternate years.

Offered fall semester.

Prerequisites, Geol 530 and 520; 722 desirable.

Mr. Haggerty.

784. NON-METALLIFEROUS ECONOMIC GEOLOGY.

Geology, distribution, and utilization of nonmetallic mineral deposits, including coal and other solid hydrocarbons. Given in alternate years.

Offered fall semester.

Prerequisites, Geol 530, 520, 550, and 611.

Mr. Farquhar.

786. HYDROGEOLOGY.

Theoretical and practical hydrogeology; ground-water hydraulics, chemistry of ground water, field methods, relation of ground water to geology, basinal, and regional ground-water problems.

Offered fall semester.

Prerequisites, one year of geology; one year of chemistry and Math 124 or equivalent recommended.

Mr. Motts.

790. SEMINAR.

Review of current literature or discussion of selected topics. *Credit, 1 each semester.*

805. EVOLUTION OF GEOLOGIC CONCEPTS.

Perspective on current geological thought in the light of its historical background; particular attention to controversial questions and to the rise and decline of ruling theories.

Offered spring semester.

Prerequisite, one year of graduate study.

Credit, 2. Mr. Motts.

846. CENOZOIC STRATIGRAPHY.

Occurrence, correlation, and origin of marine and terrestrial Cenozoic deposits and their relation to paleogeographic and tectonic conditions, with particular reference to North America.

Offered fall semester.

Prerequisites, Geol 550 and 660; 735 recommended.

Mr. Webb.

863. PHYSIOGRAPHY OF NORTH AMERICA.

A survey of the physiographic provinces of North America and their evolution. Emphasis on problems and the methods of approach.

Offered fall semester.

Prerequisites, Geol 660 and 735 desirable. Mr. Motts.

887. ADVANCED HYDROGEOLOGY.

Advanced ground-water hydrology, analog models, pumping tests, flow-duration curves, flow nets, Hubbert's hydrologic models, water chemistry, and geophysical methods of investigation.

Offered spring semester.

Prerequisites, Geol 786 and Math 124, or permission of instructor. Mr. Motts.

890. SEMINAR IN NORTHERN APPALACHIAN GEOLOGY.

The stratigraphy, structure, petrology, and geophysics of the Northern Appalachians and current research being conducted in the region.

Offered spring semester.

Prerequisites, Geol 531, 550, and 621 or equivalents.

Credit, 1-3. Mr. Hall, Mr. Robinson, Mr. Wise.

891. SEMINAR IN STRUCTURAL GEOLOGY.

Review and discussion of current research in structural geology.

Offered fall semester.

Prerequisite, at least one graduate course in structural geology. *Credit, 1-3.*

Mr. McGill, Mr. Hall, Mr. Wise, Mr. Robinson.

892. SEMINAR IN SEDIMENTOLOGY.

Depositional and diagenetic processes in terrigenous and carbonate environments and the interpretation of the rock record. *Credit, 1-3.* Mr. Hubert.

893. SEMINAR IN PLEISTOCENE GEOLOGY.

Current work and publications in glaciology, glacial geology, and related aspects of Quaternary history. Studies of related fields, such as archaeology, early man, geochronology, palynology, plant geography, and paleontology.

Prerequisite, permission of instructor.

Credit, 1-3. Mr. Hartshorn.

894. SEMINAR IN PETROLOGY.

The literature of igneous and metamorphic petrology and related aspects of mineralogy.

Prerequisites, Geol 611 and 671 or equivalents.

Credit, 1-3. Mr. Robinson, Mr. Morse,

Mr. Jaffe, Mr. Haggerty, Mr. Hall.

800. MASTER'S THESIS.

Credit, 10.

900. DOCTORAL DISSERTATION.

Credit, 30.

COURSES OPEN TO BOTH GRADUATE AND UNDERGRADUATE STUDENTS

(For either major or minor credit)

611. OPTICAL MINERALOGY.

Principles of optics; optical properties of minerals and methods for their measurement, relationship between optical properties and crystallography; mineral identification by the immersion method; crystal chemistry of rock-forming minerals.

Offered fall semester.

Prerequisites, Geol 192, Physics 141 and 142.

Mr. Jaffe, Mr. Hall, Mr. Morse.

621. PETROGRAPHY.

Identification of minerals in thin section; study of common igneous, sedimentary, and metamorphic rocks in thin section; routine petrographic calculations and measurements; introduction to petrogenetic theory. Exam-

ination of selected igneous and metamorphic rocks in the field.

Offered spring semester.

Prerequisites, Geol 220 and 611.

Mr. Robinson.

630. TECTONICS.

Past and present mechanisms creating the broader framework of global geology; mountain-building, ocean-basin structure, continental drift, mantle processes, continental evolution, early history of the earth, structural geology of selected key regions of the globe.

Offered fall semester.

Prerequisites, Geol 531, 520; undergraduates by permission.

Mr. Wise.

632. ADVANCED GEOLOGICAL MAPPING.

Complete series of operations required for publication of a geological map: field location and drawing of contacts, collection and interpretation of field notes, automated data reduction, drafting, and methods of reproduction.

Offered fall semester.

Prerequisites, Geol 220 and 231, or equivalent training.

Mr. Robinson, Mr. Wise.

634. ASTROGEOLOGY.

Geology of the solar system with particular emphasis on the solid bodies: age, sequence of events, composition, surficial and internal geologic processes. Photogeologic mapping of selected portions of Moon and Mars using recent imagery from the space program.

Offered fall semester.

Prerequisites, Geol 531, 520; undergraduates by permission.

Mr. Wise.

651. GEOMETRICS.

Design of geological experiments; the collection and analysis of quantitative data in geology.

Offered fall semester.

Prerequisite, permission of instructor.

Mr. Hubert.

655. PHYSICAL OCEANOGRAPHY.

Physical properties of sea water and their variations; water masses and their circulation patterns; interaction between ocean and atmosphere; dynamics of waves, tides, and ocean currents; techniques of oceanographic study.

Offered fall semester.

Prerequisites, two years of college work toward a major in science or engineering: Physics 141 and 142; or 161, 162, and 163; calculus recommended.

Mr. Perry.

660. GEOMORPHOLOGY.

Origin and development of landforms in relation to geological processes, climate, and tectonic history. Application of geomorphic methods to interpretation of geologic history.

Offered fall semester.

Prerequisite, Geol 230 or permission of instructor.

Mr. Doebling.

666. PLEISTOCENE GEOLOGY.

Geochronology of Pleistocene time as related to climatic changes and their influence on glaciology, erosional and depositional processes, landforms, sedimentary deposits, shifting sea level, and the paleontological record. Field trips by arrangement.

Offered spring semester.

Prerequisite, permission of instructor.

Mr. Hartshorn.

668. PHOTOGEOLOGY AND REMOTE SENSING.

Laboratory study of the instruments and methods employed in making measurements and preparing base maps and geologic maps from vertical and oblique aerial photos, together with applications of other remote-sensing techniques.

Offered spring semester.

Prerequisite, Geol 531.

Mr. Smith.

670. GEOPHYSICS.

The physics of the earth and the gravitational, magnetic, electrical, and seismic methods of geophysical exploration. Laboratory problems and computations.

Offered fall semester.

Prerequisites, Geol 230 and 520, or permission of instructor.

Mr. Bromery.

COURSES NOT FOR MAJOR CREDIT

(No graduate credit for students majoring in Geology)

520. INTRODUCTORY PETROLOGY.

The classes of rocks with reference to manner of origin, modes of occurrence, structural features, and the chemical and petrographic distinctions within each group.

Offered spring semester.

Prerequisite, Geol 192.

Credit, 4. Mr. Jaffe, Mr. Hall, or Mr. Morse.

530. FIELD AND STRUCTURAL GEOLOGY I.

Basic methods of field geology; occurrences and recognition of geologic structure; preparation and interpretation of geologic maps; solution of simple structural problems.

Offered fall semester.

Prerequisite, an introductory geology sequence.

Mr. McGill, Mr. Hall, Mr. Wise.

531. FIELD AND STRUCTURAL GEOLOGY II.

Structural and dynamic analysis of deformed rocks; introduction to tectonics; field study of complex areas.

Offered spring semester.

Prerequisites, Geol 520, 530.

Mr. Hall, Mr. Robinson, Mr. Wise.

540. INVERTEBRATE PALEONTOLOGY.

History, development, and identification of invertebrate animal fossils. Field trips by arrangement.

Offered fall semester.

Prerequisite, an introductory geology sequence or permission of instructor.

Mr. Pitrat.

550. SEDIMENTOLOGY.

Processes acting on sediments; composition, primary structures, origin, and classification of sedimentary rocks.

Offered fall semester.

Prerequisite, Geol 520.

Mr. Hubert.

551. STRATIGRAPHY AND HISTORICAL GEOLOGY.

Principles of stratigraphic correlation; methods of reconstruction of earth history; tectonic evolution of selected regions.

Offered spring semester.

Prerequisites, Geol 520, 530, 540, and 550, or permission of instructor.

Mr. Webb.

580. ENGINEERING GEOLOGY.

Materials and surface features of the earth and their relation to engineering problems; map reading as related to the phenomena of physical geology.

Offered spring semester.

Mr. Farquhar.

589. FIELD PROBLEMS.

Directed field study and/or research.

One week of full-time summer work for each credit.

Prerequisites, approval of faculty adviser and department head.

Germanic Languages and Literatures

GRADUATE FACULTY

CARROLL E. REED, *Head of Department of Germanic Languages and Literatures and Professor, B.A., Uni-*

versity of Washington, 1936; M.A., 1937; Ph.D., Brown University, 1941.

FRIEDRICH WILHELM VON KRIES, *Director of Graduate Studies and Associates Professor*, B.A., University of British Columbia, 1957; M.A., University of Washington, 1962; Ph.D., 1965.

SIGRID BAUSCHINGER, *Associate Professor*, Ph.D., University of Frankfurt, 1959.

E. M. BEEKMAN, *Associate Professor*, B.S., University of California at Berkeley, 1963; Ph.D., Harvard University, 1968.

JURGEN BORN, *Associate Professor*, B.A., Free University of Berlin, 1953; M.A., Harvard University, 1955; Ph.D., Northwestern University, 1963.

JAMES E. CATHEY, *Assistant Professor*, B.S., Oregon State University, 1962; M.A., University of Washington, 1964; Ph.D., 1967.

HORST DENKLER, *Professor*, Ph.D., University of Münster, 1963.

JOHANNES HAUPT, *Assistant Professor*, Ph.D., Rice University, 1968.

HENRY A. LEA, *Associate Professor*, B.S., (Education), University of Pennsylvania, 1942; M.A., 1951; Ph.D., 1962.

WILFRIED MALSCH, *Professor*, Ph.D., University of Freiburg, 1957; Habil, Tübingen, 1968.

VOLKER MEID, *Associate Professor*, Ph.D., University of Frankfurt, 1965.

WOLFGANG PAULSEN, *Professor*, Ph.D., University of Berne, 1934.

ALBERT M. REH, *Associate Professor*, University of Munich, 1957.

LAWRENCE RYAN, *Professor*, B.A., University of Sydney, 1953; Ph.D., University of Tübingen, 1958.

EVA SCHIFFER, *Associate Professor*, B.S., University of Massachusetts, 1946; M.A., Radcliffe College, 1947; Ph.D., 1962.

ASSOCIATED FIVE-COLLEGE GRADUATE FACULTY

SIDONIE CASSIRER, *Assistant Professor* (Mount Holyoke College), B.A., Hunter College, 1948; M.A., Yale, 1950; Ph.D., 1957.

MURRAY B. PEPPARD, *Professor* (Amherst College), B.A., Amherst, 1939; M.A., Yale, 1942; Ph.D., 1948.

WILLY SCHUMANN, *Associate Professor* (Smith College), B.A., Southern Methodist University, 1952; M.A., 1953; Ph.D., Columbia University, 1959.

FIVE-COLLEGE COOPERATIVE PH.D. REQUIREMENTS

For Candidates Specializing in Modern German literature

The following courses are required:

1. 702, Old High German, or 703, Gothic, or 704, Old Norse, or 705, Old Saxon, or English 702, Old English.
2. One course in medieval literature
3. Two courses in the literature of the 15th, 16th, and 17th centuries.
4. In general, it is expected that the remaining

courses will be chosen from the literature courses offered by the Department.

For Candidates specializing in Medieval Literature

The following courses are required:

1. 702, Old High German.
2. 704, Old Norse, or 705, Old Saxon, or 703, Gothic, or English 702, Old English, or French 710, Old French.
3. Two courses in German literature from the 15th century to the present.
4. Two courses in modern German literature.

In general, it is expected that the remaining courses will be chosen from the medieval literature courses offered by the Department. Recommendations for additional courses: one course in medieval history, one course in medieval philosophy.

For Candidates specializing in Germanic Philology

The normal program requires the completion of six courses in Philology, two courses in Linguistics, one course in Medieval Literature, and one course in Modern Literature.

Language requirement: Candidates for the Ph.D. will be required to show advanced proficiency in two foreign languages (other than German or English) pertinent to their field of specialization.

THE MASTER OF ARTS DEGREE PROGRAM

The M.A. degree program is designed to provide both a program meaningful in itself and a foundation for further progress toward the Ph.D.

The Department reserves the right to grant the M.A. as a terminal degree; admission to candidacy for the Ph.D. requires the Department's permission and does not follow automatically upon completion of the M.A. However, a student who has shown sufficient promise in his first year's work may, after receiving special written notification from the Department, advance directly to candidacy for the Ph.D. degree. Such a student is nevertheless required to fulfill the normal M.A. course requirements. The M.A. degree in such cases is granted when the student has successfully completed the qualifying examination for the Ph.D. (i.e. Comprehensives). Prerequisites for admission include a B.A. degree with a major in German language and literature and indication of ability to do successful graduate work. Deficiencies in literary background and insufficient command of spoken or written German must be remedied.

Language requirement: For the M.A. degree the Department requires proficiency in one language other than German or English, preferably French. The level of proficiency shall be "advanced," as defined by the Graduate School.

Program of study: Ten courses (30 credit hours) are required of all M.A. candidates by University regulation. Full-time students are normally expected by the Department to take a minimum of *three* courses in each semester of their first academic year. Those holding Teaching Assistantships in the Department are expected to complete their course requirements for the M.A. within four consecutive semesters of the regular academic year. The suc-

cessful completion of the following courses is required:

585. Structure of German or 559, History of German.

701. Middle High German.

720. Advanced Composition and Translation.

777. Bibliography and Methodology.

In addition, the following course is required of all Teaching Assistants and is strongly recommended to all who plan to teach German, especially at the college level: 564, Problems and Methods of Teaching German. Also, five courses selected from the Department's offerings of literature courses, including those in medieval literature; the five courses must include at least two courses in the literature of the Classic-Romantic period, at least one course in the literature of the 20th Century.

ALL COURSES CARRY 3 CREDITS UNLESS OTHERWISE SPECIFIED

COURSES OPEN TO GRADUATE STUDENTS ONLY

(For either major or minor credit)

700. SPECIAL PROBLEMS.

Directed study in some special area of literature or philology. Open to Ph.D. candidates only, except by special permission. *Credit, 1-3.*

701. MIDDLE HIGH GERMAN.

Readings in Middle High German literature with an introduction to the grammar.

702. OLD HIGH GERMAN.

Grammar and reading of prose and poetry; an introduction to Old High German dialects.

703. GOTHIC.

Grammar and reading of texts.

704. OLD NORSE.

Grammar and reading of sagas.

705. OLD SAXON.

Grammar and reading of selections from the *Heliand*.

710. COMPARATIVE GERMANIC GRAMMAR I (Phonology).

The sound systems of the various Germanic dialects from a synchronic and diachronic point of view.

Prerequisites, any two of the following: 701, 702, 703, 704, 705.

711. COMPARATIVE GERMANIC GRAMMAR II (Morphology).

The grammatical structure of the various Germanic dialects from a synchronic and diachronic point of view.

Prerequisite, German 710.

712. GERMAN DIALECTOLOGY.

Modern German dialects, their differentiation and structural analysis.

Prerequisite, German 701 or 702 or special permission.

715. THE HEROIC EPIC.

A detailed study of *Nibelungenlied* and *Kudrun* with reference to the pre-courtly epic and later *Dietrichsepik*. (Offered in alternate years; offered 1974-5.)

Prerequisite, German 701.

716. COURTLY LYRIC POETRY.

An introduction to the formal study of *Minnesang* and *Spruchdichtung* from the Kürenberger to Konrad von Würzburg with emphasis on Walther von der Vogel-

weide and the social and historical context of the period.

(Offered in alternate years; offered 1973-4.)

Prerequisite, German 701.

717. THE COURTLY EPIC.

A comprehensive literary analysis of selected epics by Hartmann von Aue, Wolfram von Eschenbach, Gottfried von Strassburg.

(Offered in alternate years; offered 1973-4.)

720. ADVANCED COMPOSITION AND TRANSLATION.

Required of all degree candidates. May be waived for students judged to have native speaking proficiency.

730. LITERATURE OF THE 15TH AND 16TH CENTURIES.

Humanism and Reformation.

733. 17TH-CENTURY POETRY AND PROSE.

Poetry and prose and relevant poetic theories.

734. 17TH-CENTURY DRAMA.

Drama and relevant poetic theories.

740. 18TH-CENTURY DRAMA.

German drama from Christian Weise to Lessing; dramatic theory.

745. 18TH-CENTURY POETRY AND PROSE.

Development of poetry and prose during the Aufklärung. Poetry from Brockes to Sturm und Drang, and prose from Schnabel to Wieland.

749. THE CLASSICAL GOETHE.

The major works of Goethe's Weimar period; poetry, drama, fiction.

750. THE LATER GOETHE.

751. GOETHE'S FAUST.

752. SCHILLER.

Schiller's literary and philosophical works.

758. EARLY ROMANTICISM.

Philosophical background and literary works of the early Romantic movement.

759. LATER ROMANTICISM.

Later development of Romanticism from Brentano to Heine, including the anti-Romantic tendencies of the time.

763. 19TH-CENTURY POETRY AND PROSE.

Poetry by Heinrich Heine, Eduard Mörike, Annette von Droste-Hülshoff a.o. and of prose by Heinrich Heine and the writers of Biedermeier and Das Junge Deutschland.

764. 19TH-CENTURY DRAMA.

Kleist, Grillparzer, Büchner, Grabbe, Hebbel.

765. LITERATURE OF REALISM.

From Gotthelf to Fontane.

771. 20TH-CENTURY POETRY I.

Emphasis on George, Hofmannsthal, Rilke.

772. 20TH-CENTURY POETRY II.

Emphasis on expressionist and post-expressionist poetry.

773. 20TH-CENTURY PROSE I.

The early Thomas Mann and his generation.

774. 20TH-CENTURY PROSE II.

New trends of fiction after the First World War.

775. 20TH-CENTURY DRAMA.
From Wedekind to Brecht.

777. BIBLIOGRAPHY AND METHODOLOGY.
An introduction to tools and methods of research. Required of all candidates for graduate degrees. Corequisite, 780.

778. STRUCTURE AND HISTORY OF GERMAN VERSE.

779. POST-WORLD WAR II GERMAN LITERATURE.

780. PROSEMINAR.
Interpretation of texts and introduction to critical terminology. Required of all candidates for graduate degrees. Corequisite, 777.

782. SPECIAL TOPICS IN PHILOLOGY AND MEDIEVAL STUDIES.

783. SPECIAL TOPICS IN THE LITERATURE OF CLASSICISM.

784. SPECIAL TOPICS IN THE LITERATURE OF ROMANTICISM.

785. SPECIAL TOPICS IN THE LITERATURE OF THE 19TH CENTURY.

786. SPECIAL TOPICS IN THE LITERATURE OF THE 20TH CENTURY.

787. HISTORY OF AESTHETIC THEORIES IN GERMANY.
General trends in the history of aesthetics. Discussion of major works since Opitz.

788. HISTORY AND PROBLEMS OF LITERARY CRITICISM.

790. SEMINAR IN LITERATURE.

791. SEMINAR IN PHILOLOGY.

792. SEMINAR IN MEDIEVAL LITERATURE.

900. DOCTORAL DISSERTATION. *Credit, 30.*

COURSE NOT FOR MAJOR CREDIT

409, 410. GRADUATE READING COURSE.
For graduate students preparing for the M.A. or Ph.D. reading examination. No previous knowledge of German required. *No credit.*

COURSES OPEN TO BOTH GRADUATE AND UNDERGRADUATE STUDENTS.

(For either major or minor credit)

559. HISTORY OF GERMAN.
Introduction to the history of the German language.

564. PROBLEMS AND METHODS OF TEACHING GERMAN.
Various methods of teaching a foreign language based on recent developments in applied linguistics and programmed learning. Emphasized are the development of teaching materials by the individual student and the application of textbooks to the needs of various language courses.
Prerequisite, advanced proficiency in German.

585. STRUCTURE OF GERMAN.
An introduction to the principles of linguistics and the structure of the German language.

DUTCH STUDIES

DUTCH 551. DUTCH-FLEMISH LITERATURE.
Selections of masterpieces from the 19th and 20th centuries. Emphasis on poetry and contemporary writers. Prerequisite: Dutch 141 or its equivalent.

SCANDINAVIAN STUDIES

DANISH 551. DANO-NORWEGIAN LITERATURE.
Masterpieces of Danish and Norwegian literature. Emphasis on Ibsen, Holberg, and some attention to modern writers.

SWEDISH 551. SWEDISH LITERATURE.
Introduction to Swedish literature. Emphasis on Strindberg and the modern authors.
Prerequisite, Swedish 140 or equivalent.

RELATED COURSES:

Comparative Literature

631. THE ENLIGHTENMENT.

641. ROMANTICISM.

642. FROM IDEALISM TO REALISM.

651. SYMBOLISM.

652. MODERN DRAMA.

661. THE CONTEMPORARY EUROPEAN NOVEL.

675. ANGLO-GERMAN LITERARY RELATIONSHIPS.

Linguistics

501. GENERAL LINGUISTICS.

502. PHONOLOGICAL THEORY.

503. SYNTAX.

707. COMPARATIVE LINGUISTICS.

710. SEMANTICS.

713. LINGUISTICS AND LITERATURE.

714. CONTEMPORARY APPROACHES TO PHONETICS.

English

702. OLD ENGLISH.

703. MIDDLE ENGLISH.

705. OLD ENGLISH LITERATURE.

706. MIDDLE ENGLISH LITERATURE.

708. CHAUCER.

French

711. OLD FRENCH READINGS.

715. THE "ROMAN COURTOIS."

717. MEDIEVAL EPIC POETRY.

719. THE MEDIEVAL THEATER.

Hispanic Languages and Literatures

GRADUATE FACULTY

HAROLD L. BOUDREAU, *Chairman of the Department of Hispanic Languages and Literatures and Professor*, B.A., Illinois, 1948; M.A., 1950; Ph.D., Wisconsin, 1965.

ROBERT L. BANCROFT, *Professor*, B.A., Washington, 1935; M.A., 1947; Ph.D., Columbia, 1957.

PEDRO BARREDA-TOMÁS, *Associate Professor*, M.A., State University of New York at Buffalo, 1966; Ph.D., 1969.

BLANCHE DE PUY, *Associate Professor*, B.A., Wellesley, 1942; M.Litt., Pittsburgh, 1951; Ph.D., Stanford, 1961.

FRANCISCO FERNÁNDEZ-TURIENZO, *Assistant Professor*, B.A., Universidad Pont. de Salamanca, 1956; M.A., University of Basilea (Switzerland), 1965; Ph.D., 1965.

SUMNER M. GREENFIELD, *Professor*, B.A., Boston College, 1946; M.A., Boston University, 1947; M.A., Harvard, 1951; Ph.D., 1957.

JULES PICCUS, *Professor*, B.A., Queens, 1942; M.A., Princeton, 1949; Ph.D., 1951.

IRVING P. ROTHBERG, *Professor*, B.S., Temple University, 1948; M.A., Pennsylvania State, 1951; Ph.D., 1954.

HARLAN G. STURM, *Assistant Professor*, B.A., University of Minnesota, 1963; M.A., 1965; Ph.D., University of North Carolina, 1967.

SIDNEY F. WEXLER, *Professor*, B.S., New York University, 1932; M.A., Colorado, 1933; Ph.D., New York University, 1952.

JUAN C. ZAMORA, *Assistant Professor*, M.A., State University of New York at Buffalo, 1966; Ph.D., 1971.

ASSOCIATED FIVE-COLLEGE GRADUATE FACULTY

JOAN E. CIRUTI, *Professor* (Mount Holyoke College), B.A., Southeastern Louisiana College, 1950; M.A., University of Oklahoma, 1954; Ph.D., Tulane, 1959.

ERNEST A. JOHNSON, JR., *Professor of Romance Languages* (Amherst College), B.A., Amherst, 1939; M.A., Chicago, 1940; Ph.D., Harvard, 1950.

ERNA R. BERNDT KELLEY, *Associate Professor* (Smith College), B.A., Wisconsin, 1954; M.A., 1955; Ph.D., 1959.

JOAQUINA NAVARRO, *Professor* (Smith College), B.A., Instituto Escuela, Madrid, 1934; M.A., Columbia, 1942; Ph.D., 1954.

EUGENIO SUÁREZ-GALBÁN, *Associate Professor* (Mount Holyoke), B.A., Boston College, 1961; M.A., New York University, 1964; Ph.D., 1967.

COURSE REQUIREMENTS FOR THE MASTER OF ARTS DEGREE

Students are required to have oral and written proficiency in Spanish before admission to candidacy

for advanced degrees. In addition to the general requirements for the degree at the University, the following special requirements must be met:

1. Spanish 705 (Bibliography and Methods).
2. A reading knowledge of a second foreign language pertinent to the student's program.
3. Spanish 800 may be elected for not more than nine credits.
4. Terminal examinations as follows:
 - a. Comprehensive examination.
 - b. For those electing Spanish 800, oral defense of thesis.

Students are advised to elect Spanish 710 (History of the Spanish Language).

THE FIVE-COLLEGE COOPERATIVE Ph.D. PROGRAM

The University requirements for admission to the Graduate School specify acceptance by the department. For the Cooperative Ph.D. in Spanish, acceptance is by the Spanish departments of four participating institutions—Amherst, Mount Holyoke, Smith, and the University.

In addition to the general requirements for the degree at the University, the following special requirements must be met:

1. Required courses:
 - a. Spanish 705 (Bibliography and Methods), or the equivalent knowledge.
 - b. One semester each of Romance Philology and the History of the Spanish Language. (Both Spanish 710.)
 - c. Spanish 900, Doctoral Dissertation.
 2. A reading-knowledge at the intermediate or advanced level as determined by the department, of Latin, French, and either German or another foreign language pertinent to the student's program.
 3. Oral and written comprehensive examinations demonstrating proficiency in the language, a knowledge of the whole body of Spanish and Spanish-American literature and of the history of the language, and evidence of knowledge of the history and the culture of Hispanic countries.
- N.B.: Graduate programs in the Department of Hispanic Languages and Literatures are in the process of revision. Contact the Department for more up-to-date information.)

ALL COURSES CARRY 3 CREDITS UNLESS OTHERWISE SPECIFIED

COURSES OPEN TO GRADUATE STUDENTS ONLY

(For either major or minor credit)

420. ADVANCED CONVERSATIONAL SPANISH.
Intended primarily for first-year graduate students. Intensive oral practice to insure fluency. Phonetic variants within the Hispanic World.
One or two hours per week throughout the year.
Credit, 2. Mr. Wexler.

700. PROBLEM COURSE.
Directed study in some phase of linguistics or literature.
Credit, 1-6.

705. BIBLIOGRAPHY AND METHODS OF LITERARY RESEARCH.
Specific topics of Spanish 710 through 799 announced in the spring of the preceding academic year. Mr. Piccus.

710. THE SPANISH LANGUAGE.

The development of Spanish and its relationship to other Romance languages. *Credit, 3-12.* Mr. Piccus.

715. SEMINARS IN EARLY MEDIEVAL LITERATURE.

A phase of Spanish literature of the 12th and 13th centuries.

Prerequisite, a knowledge of Latin, Spanish 710, or equivalent. *Credit, 3-12.* Mr. Piccus, Mr. Sturm.

720. SEMINARS IN LATER MEDIEVAL LITERATURE.

A phase of Spanish literature of the 14th and 15th centuries. *Credit, 3-12.* Mr. Piccus, Mr. Sturm.

730. SEMINARS IN RENAISSANCE AND BAROQUE LITERATURE.

Aspects of Spanish intellectual and spiritual movements of the 16th and 17th centuries as reflected in Renaissance and Baroque literature.

Credit, 3-12. Mr. F-Turienzo, Mr. Rothberg.

735. SEMINARS IN 16TH- AND 17TH-CENTURY POETRY.

The poets and poetic currents of the Spanish Golden Age. *Credit, 3-12.* Mr. F-Turienzo, Mr. Rothberg.

740. SEMINARS IN GOLDEN-AGE FICTION.

Aspects of the novel in 16th- and 17th-century Spain.

Credit, 3-12. Mr. F-Turienzo, Mr. Rothberg.

745. SEMINARS IN THE 16TH-AND 17TH-CENTURY THEATER.

The development and apogee of the Spanish *comedia* in the Golden Age. *Credit, 3-12.* Mr. Rothberg.

755. SEMINARS IN 18TH-CENTURY LITERATURE.

Phases of Spanish thought and literature in the 18th century. *Credit, 3-12.* Mr. Greenfield.

760. SEMINARS IN 19TH-CENTURY POETRY AND DRAMA.

Aspects of the theater and poetry of 19th-century Spain. *Credit, 3-12.* Mr. Boudreau, Mr. Greenfield.

765. SEMINARS IN 19TH-CENTURY PROSE.

Nineteenth-century Spanish thought or narrative literature. *Credit, 3-12.*

Mr. Boudreau, Ms. De Puy, Mr. Greenfield.

770. SEMINARS IN INTELLECTUAL AND ESTHETIC MOVEMENTS.

Intellectual and esthetic developments in the modern Hispanic world. *Credit, 3-12.*

Ms. De Puy, Mr. F-Turienzo, Mr. Greenfield.

775. SEMINARS IN 20TH-CENTURY POETRY AND DRAMA.

Phases of modern Spanish poetry and theater.

Credit, 3-12. Mr. Boudreau, Mr. Greenfield.

780. SEMINARS IN 20TH-CENTURY PROSE.

The novel, short story, and essay in modern Spain.

Credit, 3-12.

Mr. Boudreau, Ms. De Puy, Mr. Greenfield.

785. SEMINARS IN SPANISH-AMERICAN POETRY AND DRAMA.

Individual Spanish-American poets or dramatists, and in groups or movements.

Credit, 3-12. Mr. Bancroft, Mr. Barreda.

790. SEMINARS IN SPANISH-AMERICAN PROSE.

The novel, short story, chronicle, and essay in Spanish America. *Credit, 3-12.* Mr. Bancroft, Mr. Barreda.

799. SEMINARS IN HISPANIC LANGUAGE AND LITERATURE.

Phases of Spanish language and Spanish and Spanish-American literature that involve two or more of the areas of courses number 710 through 790. *Credit, 3-12.*

800. MASTER'S THESIS.

Maximum credit, 9.

900. DOCTORAL DISSERTATION.

Credit, 15.

COURSES OPEN TO BOTH GRADUATE AND UNDERGRADUATE STUDENTS

(For either major or minor credit)

607. THE TEACHING OF SPANISH.

A systematic analysis of the major problems anticipated in the teaching of Spanish. Mr. Zamora

608. SPANISH PHONETICS.

Spanish phonetic theory and its application to the teaching of Spanish.

3 class hours, 1 laboratory session.

Mr. Zamora.

609. ADVANCED GRAMMAR.

Finer details and shades of Spanish grammar.

Mr. Zamora.

610. ADVANCED COMPOSITION.

The elements of stylistics.

Mr. Barreda.

615. SPANISH LITERATURE TO 1500.

Spanish literature in the Middle Ages and Renaissance.

Mr. Piccus, Mr. Sturm

617. SPANISH MEDIEVAL POETRY.

Lyric, romancero, epic, and other narrative poetry of the Iberian Peninsula.

Mr. Piccus, Mr. Sturm.

618. SPANISH MEDIEVAL PROSE.

Important novelistic, historical, and didactic prose works of medieval Spain.

Mr. Piccus, Mr. Sturm.

625. PROSE OF THE GOLDEN AGE.

Major prose works in 16th- and 17th-century Spain. Emphasis on the novel, excluding the *Quijote*.

Mr. F-Turienzo, Mr. Rothberg.

630. CERVANTES.

Intensive study of the *Quijote*.

Mr. F-Turienzo.

635. LYRIC POETRY OF THE GOLDEN AGE.

Spanish poetry of the 16th and 17th centuries from Garcilaso to Gongora.

Mr. F-Turienzo, Mr. Rothberg.

640. DRAMA OF THE GOLDEN AGE.

The *comedia* during the period of maximum creation, 1556-1681.

Mr. Rothberg, Mr. Sturm.

655. SPANISH LITERATURE FROM 1700 THROUGH ROMANTICISM.

Spanish literature and thought in the 18th century and the Romantic movement.

Mr. Greenfield.

665. THE SPANISH NOVEL AND DRAMA IN THE LATE 19TH CENTURY.

Post-Romantic literature of Spain in the 19th century. Emphasis on prose fiction.

Mr. Boudreau, Ms. De Puy, Mr. Greenfield.

670. SPANISH-AMERICAN LITERATURE TO 1900.

A general view, with intensive study of selected major works.

Mr. Bancroft, Mr. Barreda.

671. THE MODERNISTA MOVEMENT.

Modernismo in Spanish America, including a comparative study of its manifestations in Spain.

Mr. Bancroft, Mr. Barreda, Mr. Greenfield.

673. SPANISH-AMERICAN POETRY AND DRAMA SINCE MODERNISMO.

The principal authors and movements in the 20th century.

Mr. Bancroft, Mr. Barreda.

675. CONTEMPORARY PROSE FICTION IN SPANISH AMERICA.

The recent novel and short story.

Mr. Bancroft, Mr. Barreda.

681. DRAMA AND POETRY IN TWENTIETH-CENTURY SPAIN.

Spanish poetry and the theater from the Generation of '98 to the present.

Mr. Boudreau, Mr. Greenfield.

683. MODERN SPANISH POETRY FROM BÉCQUER TO THE PRESENT.

Selected poetry of the 19th-century post-romantics and realists, the Generation of '98, Juan Ramón Jiménez, the group of 1927, and the post-Civil War social poets.

Mr. Boudreau, Ms. Soons.

684. THE ESSAY IN MODERN SPAIN.

Selections from the Krausista movement, Joaquín Costa, the Generation of '98, Ortega and the *novacentistas*, and post-Civil War thinkers: Aranguren, Lain Entralgo, and others. Mr. Greenfield, Ms. De Puy, Mr. F-Turienzo.

COURSE NOT FOR MAJOR CREDIT

409. GRADUATE READING COURSE.

For graduate students preparing for the M.A. or Ph.D. reading examination. No previous knowledge of Spanish required. *No credit.*

History

GRADUATE FACULTY

ROBERT H. MCNEAL, *Chairman of the Department of History and Professor*, B.A., Yale, 1952; M.A., Columbia, 1954; Ph.D., 1958.

GEORGE E. KIRK, *Director of Graduate Studies in History and Professor*, B.A., Cambridge, 1932; Diploma in Classical Archaeology, 1933; M.A., 1936.

DEAN ALBERTSON, *Professor*, B.A., California at Berkeley, 1942; M.A., 1947; Ph.D., Columbia, 1955.

HUGH F. BELL, *Assistant Professor*, B.A., Princeton, 1941; J.D., Michigan, 1948; Ph.D., Cornell, 1970.

WINFRED E. A. BERNHARD, *Professor*, B.S., Harvard, 1942; M.A., Columbia, 1948; Ph.D., 1961.

PAUL S. BOYER, *Associate Professor*, B.A., Harvard, 1960; M.A., 1961; Ph.D., 1966.

MILTON CANTOR, *Associate Professor*, B.A., Brooklyn, 1947; M.A., Pennsylvania, 1948; Ph.D., Columbia, 1954.

MIRIAM U. CHRISMAN, *Professor*, B.A., Smith, 1941; M.A., American University, 1948; M.A., Smith, 1955; Ph.D., Yale, 1962.

WILLIAM A. DAVIS, *Associate Professor*, B.A., Colgate, 1935; M.A., Harvard, 1938; Ph.D., 1956.

MARIO S. DEPILLIS, *Associate Professor*, B.A., Chicago, 1952; M.A., 1954; Ph.D., Yale, 1961.

FRED W. DRAKE, *Assistant Professor*, B.A., Stanford, 1961; M.A., 1963; M.A., Harvard, 1965; Ph.D., 1971.

HAROLD J. GORDON, JR., *Professor*, B.A., Richmond, 1940; M.A., Yale, 1948; Ph.D., 1953.

LOUIS S. GREENBAUM, *Professor*, B.A., Wisconsin, 1950; M.A., 1951; Ph.D., Harvard, 1955.

ROBERT W. GRIFFITH, *Associate Professor*, B.A., DePauw, 1962; M.A., Wisconsin, 1964; Ph.D., 1967.

LEWIS HANKE, *Professor*, B.S., Northwestern, 1924; M.A., 1925; Ph.D., Harvard, 1936.

ROBERT A. HART, *Associate Professor*, B.A., Indiana, 1954; M.A., 1959; Ph.D., 1964.

JOSEPH M. HERNON, JR., *Associate Professor*, B.A., Catholic University, 1959; Ph.D., Trinity College, Dublin, 1963.

VINCENT ILARDI, *Professor*, B.A., Rutgers, 1952; M.A., Harvard, 1953; Ph.D., 1958.

WILLIAM M. JOHNSTON, *Associate Professor*, B.A., Harvard, 1958; Ph.D., 1965.

ROBERT E. JONES, *Assistant Professor*, B.A., Lafayette, 1963; Ph.D., Cornell, 1968.

BRUCE C. LAURIE, *Assistant Professor*, B.A., Rutgers, 1965; M.A., Pittsburgh, 1967; Ph.D., 1971.

ARCHIBALD R. LEWIS, *Professor*, B.A., Princeton, 1936; M.A., 1939; Ph.D., 1940.

JANE M. LOY, *Assistant Professor*, B.A., DePauw, 1962; M.A., Wisconsin, 1964; Ph.D., 1969.

GERALD W. MCFARLAND, *Associate Professor*, B.A., California at Berkeley, 1960; M.A., Columbia, 1964; Ph.D., 1965.

RICHARD H. MINEAR, *Associate Professor*, B.A., Yale, 1960; M.A., Harvard, 1962; Ph.D., 1968.

STEPHEN NISSENBAUM, *Associate Professor*, B.A., Harvard, 1961; M.A., Columbia, 1963; Ph.D., Wisconsin, 1968.

STEPHEN B. OATES, *Professor*, B.A., Texas, 1958; M.A., 1960; Ph.D., Texas, 1968.

STEPHEN E. PELZ, *Assistant Professor*, B.A., Johns Hopkins, 1964; M.A., Harvard, 1966; Ph.D., 1971.

ROBERT A. POTASH, *Professor*, B.A., Harvard, 1942; M.A., 1947; Ph.D., 1953.

HOWARD H. QUINT, *Professor*, B.A., Yale, 1940; M.A., Stanford, 1942; Ph.D., Johns Hopkins, 1947.

CHARLES W. REARICK, *Assistant Professor*, B.A., College of Idaho, 1964; M.A., Harvard, 1965; Ph.D., 1968.

LEONARD L. RICHARDS, *Associate Professor*, B.A., California at Berkeley, 1956; M.A., 1961; Ph.D., California at Davis, 1968.

ROLAND SARTI, *Associate Professor*, B.A., City College of New York, 1960; M.A., Rutgers, 1962; Ph.D., 1966.

MARVIN SWARTZ, *Assistant Professor*, B.A., Princeton, 1963; M.A., Yale, 1964; Ph.D., 1969.

PHILIP SWENSON, *Assistant Professor*, B.A., San Diego State, 1966; M.A., 1967; Ph.C., 1970; Ph.D., University of Washington, 1971.

JACK TAGER, *Associate Professor*, B.A., Brooklyn, 1958; M.A., California at Berkeley, 1959; Ph.D., Rochester, 1965.

JACK M. THOMPSON, *Assistant Professor*, B.A., South Carolina, 1949; M.A., 1953; Ph.D., 1958.

HENRY TRAGLE, *Assistant Dean and Lecturer*, B.A., University of Massachusetts, 1966; M.A., 1967; Ph.D., 1971.

RONALD D. WARE, *Associate Professor*, B.A., Cincinnati, 1950; M.S., Wisconsin, 1956; Ph.D., 1960.

FRANKLIN B. WICKWIRE, *Professor*, B.A., Hanover, 1952; M.A., Indiana, 1956; Ph.D., Yale, 1961.

MARY B. WICKWIRE, *Assistant Professor*, B.A., Wellesley, 1956; M.A., Yale, 1957; Ph.D., 1963.

DAVID WYMAN, *Associate Professor*, B.A., Boston University, 1951; M.Ed., Plymouth Teachers College, 1961; M.A., Harvard, 1962; Ph.D., 1966.

GRADUATE PROGRAMS IN HISTORY

More complete information on graduate study in History may be found in the Departmental state-

ment, *Graduate Program in History*, available from the History office. Because requirements are currently under revision, students are advised to consult the most recent edition of this statement.

THE DOCTOR OF PHILOSOPHY DEGREE PROGRAM

The Department of History offers doctoral work in six areas: Europe (including Russia), United States, Great Britain, Latin America, East Asia, Near and Middle East. Each of these areas is subdivided into a number of fields. The candidate chooses an area of specialization, and within this area a major field.

A student entering the University with previous graduate training at other institutions may be admitted to the graduate program with advanced standing at the discretion of the Department. The Department's Graduate Committee evaluates his previous graduate training, and he is informed of his exact status upon notification of admission to the Department's graduate program.

At the outset of his work, each doctoral candidate is assigned a Guidance Committee whose function it is to advise and approve courses and doctoral fields most appropriate to the student's designated major interests. A minimum of fifteen courses is required, no less than four of which will be graduate seminars in three fields. These seminars concentrate on research training and the techniques of historical writing. The candidate for the Ph.D. must be in full-time residence for no less than one academic year (two consecutive semesters).

All Ph.D. candidates must pass a departmental examination demonstrating reading proficiency in the literature of one foreign language. Students who plan to specialize in areas for which more than one foreign language is necessary for scholarly work must pass departmental examinations demonstrating reading proficiency in the literature of such relevant languages.

Each candidate for the Ph.D. is responsible for four fields, at least two of which are in his area of specialization. Not more than two fields may be offered which deal with the history of a particular nation.

The substitution of fields outside the Department of History may be elected upon recommendation of the student's adviser and approval by the department's Director of Graduate Studies. Satisfactory completion of the General Examination admits the student to formal candidacy for the Ph.D. degree. A dissertation is required of each candidate for the Ph.D.

THE MASTER OF ARTS DEGREE PROGRAMS REGULAR MASTER OF ARTS PROGRAM.

Each graduate student entering this program selects a major field of concentration from among those offered by the History Department for doctoral work. Selection of the student's adviser is based upon the student's selection of field. All M.A. candidates must demonstrate a reading proficiency in one foreign language. Students who plan to specialize in areas for which English is not the basic language are re-

quired to demonstrate to the department a reading proficiency in the relevant foreign language during the first semester of graduate study.

Admission to seminars and topics courses in some fields may depend upon the student's ability in one or more foreign languages.

Basic Course requirements.

1. Each student must complete eight courses for the Master's degree of which at least six must be in the 700-800 series. For two of these courses the student may elect to substitute the preparation of a thesis.

2. Each student may take two courses in associated disciplines at the discretion of his adviser.

3. Four courses is the normal permissible program per semester.

4. Each student must complete a minimum of one course in historiography.

5. Each student must complete two seminars with the minimum grades of B, unless he chooses to write a thesis, in which case he may be exempted from one seminar.

The candidate must pass an oral examination on his primary field of interest, to be conducted by an examining committee of three members of the graduate faculty. The student is expected to complete his program within a six-year period.

THE MASTER OF ARTS IN TEACHING PROGRAM

This program emphasizes the special needs of secondary school teachers; it stresses breadth of knowledge rather than concentration, and critical reading more than the development of research techniques.

The student is required to complete eight courses at least four of which must be in the 700 to 800 level. His program is planned with reference to preparation for teaching. He must complete a semester course entitled "The Teaching of History," and may include three courses in associated disciplines at the discretion of the adviser.

Examinations in foreign languages are not required of students in this program, yet admission to certain courses in the history of non-English speaking countries necessitates a competence in the relevant language.

Twelve credits is the normal program per semester. The student should expect to complete his program within a six-year period.

A candidate must pass an oral examination based, in consultation with his adviser, upon an appropriate range of his graduate courses including "The Teaching of History." Three members of the graduate faculty will conduct the examination. Transfer to the regular Master of Arts program may be made with the approval of the department.

ALL COURSES CARRY 3 CREDITS UNLESS OTHERWISE SPECIFIED

COURSES OPEN TO GRADUATE STUDENTS ONLY

(For either major or minor credit)

700. SPECIAL PROBLEMS IN HISTORY.

Directed research and writing for qualified students.

Prerequisite, permission of instructor.

Credit, 1-6.

701. EUROPEAN HISTORIOGRAPHY TO THE ENLIGHTENMENT.

Critical evaluation of the techniques and ideas of major historians and influential schools of historical interpretation from the Greeks through the Renaissance.

Credit, 4. Mr. Ware.

702. EUROPEAN HISTORIOGRAPHY; THE ENLIGHTENMENT TO THE PRESENT.

Techniques and ideas of major historians and influential schools of historical interpretation, and the relation of historiography to the intellectual and political history of modern Europe.

Credit, 4. Mr. Johnston.

703. AMERICAN HISTORIOGRAPHY THROUGH THE CIVIL WAR.

Interpretations of major themes as developed in the works of leading historians.

Credit, 4. Mr. Davis.

704. AMERICAN HISTORIOGRAPHY; 1865 TO THE PRESENT.

Interpretations of major themes as developed in the works of leading historians.

Credit, 4. Mr. McFarland.

705. PHILOSOPHY OF HISTORY.

The "philosophy of history" both as epistemology and as a method of explanation, and a comparison of the aims of history and the sciences. Analysis of the nature of history: the difference between truth and fact, the possibility of objectivity, and the theory of historical explanation. Major historians in the field are read, from Thucydides and Augustine to Croce and Toynbee.

Credit, 4. Mr. Johnston.

706. LATIN AMERICAN HISTORIOGRAPHY.

Techniques and interpretations developed by representative historians from the conquest to the present.

Prerequisite, reading knowledge of Spanish or Portuguese, or permission of instructor.

Credit, 4. Mr. Hanke.

707. LATE MEDIEVAL AND RENAISSANCE PALAEOGRAPHY.

Instruction in reading the scripts of original documents. Required of Ph.D. specialists in these fields.

Credit, 4. Mr. Ilardi.

708. TOPICS IN ANCIENT HISTORY, I.

The Near East and Greece. Papers may obtain seminar credit with instructor's approval.

Credit, 4. Mr. Kirk.

709. TOPICS IN ANCIENT HISTORY, II.

Early Italy and Rome, to the end of the Empire in the West. Papers may obtain seminar credit with instructor's approval.

Credit, 4. Mr. Kirk.

710. TOPICS IN HISTORY.

Readings, discussions, reports.

Credit, 4.

711. TOPICS IN EARLY MEDIEVAL HISTORY.

Continuity between ancient and medieval civilization.

Prerequisites, working knowledge of Latin and one modern language (German, French, Italian) or permission of instructor.

Credit, 4. Mr. Lewis, Mr. Ware.

712. TOPICS IN THE AGE OF THE RENAISSANCE AND REFORMATION.

European culture between 1400 and 1600. A reading knowledge of a modern European language is generally required.

Credit, 4. Mr. Ilardi.

713. TOPICS IN THE AGE OF THE ENLIGHTENMENT.

The movement of ideas in Atlantic civilization during the 18th century. The mind and writings of representative European and American thinkers. Emphasis on politics, religion, science, literature and the arts.

Credit, 4. Mr. Greenbaum.

714. TOPICS IN TUDOR AND STUART ENGLAND.

Selected aspects of the Tudor age; the interplay of social, economic, intellectual and political factors in-

volved in the Stuart Revolution. Constitutional developments emphasized.

Credit, 4. Mr. Shipley.

715. TOPICS IN RECENT EUROPEAN HISTORY.

Basic developments in diplomatic, political, social, and economic history since 1800. Emphasis on organic growth and change.

Credit, 4. Mr. Gordon.

716. TOPICS IN WORLD WAR II AND AFTERMATH.

Pre-nuclear total war in its military development and its political, economic, and social ramifications in modern Western society; the postwar settlements and their effects.

Credit, 4.

717. TOPICS IN THE RECENT SOCIAL HISTORY OF EUROPE.

The social changes resulting from the industrialization of Europe since 1815 and their relationship to economic and political developments. The methods and materials needed for effective work in recent social history. A series of short problems illustrating proper utilization of the sources.

Credit, 4. Mr. Gordon.

718. TOPICS IN NINETEENTH-CENTURY INTELLECTUAL HISTORY.

Selected major currents in European thought since the French Revolution, their origins, development, and influence. Reading knowledge of French or German is desirable.

Credit, 4.

719. PROBLEMS IN BRITISH IMPERIAL HISTORY SINCE 1783.

Aspects of such general topics as the problems of imperial government after the American Revolution, the Durham Report and the growth of the dominions, the difficulties and effect of implantation of British institutions in Asia and Africa, the lessening of British control and the Statute of Westminster, and the political and economic importance of the Commonwealth in world affairs.

Credit, 4. Mr. Wickwire.

720. TOPICS IN BRITAIN IN THE 19TH CENTURY.

Central themes and topics. Emphasis on the history of thought in its relation to political, economic, and social developments.

Credit, 4. Mr. Hernon.

721. PROBLEMS IN RUSSIAN HISTORY.

Russia in the 19th and 20th centuries. Emphasis on Russian and Soviet historiography. Intensive reading and careful analyses of selected topics.

Credit, 4. Mr. McNeal.

722. TOPICS IN MODERN SPANISH HISTORY.

Spanish history from the end of the reign of Philip II to the end of the Spanish Civil War.

Credit, 4.

730. TOPICS IN EARLY AMERICAN HISTORY.

Colonial America from discovery and settlement of the New World through the Federalist era.

Credit, 4. Mr. Bernhard.

731. TOPICS IN THE ERA OF THE CONFEDERATION AND THE CONSTITUTION.

The formative years of the American nation; the evolution of federal and state constitutions; basic political issues and conflicts; the pattern of economic and social development.

Credit, 4. Mr. Davis, Mr. Bernhard.

732. TOPICS IN THE NATIONAL PERIOD.

A reading course. Basic features of American political, social, and economic history from the rise of Jeffersonianism to the Civil War.

Credit, 4. Mr. Cantor, Mr. Richards.

733. TOPICS IN THE AMERICAN CIVIL WAR ERA.

Analysis and interpretation of slavery and abolition, Southern nationalism, the breakdown of national parties, causes of the War, wartime politics and the War's impact.

Credit, 4. Mr. Oates.

734. TOPICS IN THE GILDED AGE.

Investigation of national re-unification, Grantism, dead center politics, genteel reform, the new industrialism and business leadership, labor and agrarian problems.

Credit, 4. Mr. McFarland.

**735. TOPICS IN THE PROGRESSIVE ERA
OF THE UNITED STATES.**

Emphasis on the political, social, economic, and cultural aspects of the Progressive Era, and an analysis of the interpretations of historians and others.

Credit, 4. Mr. Quint.

**736. TOPICS IN AMERICAN DIPLOMATIC
HISTORY.**

Readings in the primary and secondary sources for the study of important phases in American diplomacy.

Credit, 4. Mr. Hart.

**737. TOPICS IN THE UNITED STATES
BETWEEN THE WORLD WARS.**

Major issues in American political, social, and economic life between the two World Wars.

Credit, 4. Mr. Quint, Mr. Wyman.

**738. TOPICS IN UNITED STATES
INTELLECTUAL HISTORY.**

Specific aspects of such general topics as the American adaptation of the European heritage, the growth of the concept of Americanism, the emergence of patrician leadership, the achievement of realistic democracy, the triumph of nationalism, the assertion of individualism in a corporate society, and the scientific-humanistic culture conflict.

Credit, 4. Mr. Quint, Mr. Cantor.

739. TOPICS IN MASSACHUSETTS HISTORY.

Development of the Commonwealth and its relationship to regional and national institutions and thought from early colonial times to the present. Abundant primary and secondary source materials. A foundation for further research.

Credit, 4.

**740. TOPICS IN UNITED STATES URBAN
HISTORY.**

The origins of the modern American city and the complex problems engendered by large-scale urbanization.

Credit, 4. Mr. Tager.

741. TOPICS IN AMERICAN SOCIAL HISTORY.

A behavioral approach to the history of American society: the family, religion, ethnicity, socialization of children, explanations of social change &c.

Credit, 4. Mr. DePillis.

**745. TOPICS IN MODERN AND CONTEMPORARY
LATIN AMERICA.**

Political, economic, social, and ideological forces in the history of Latin America since independence. Reading knowledge of Spanish or Portuguese desirable.

Credit, 4. Mr. Potash.

**748. TOPICS IN ISLAMIC AND MODERN
MIDDLE-EASTERN HISTORY AND POLITICS.**

Readings in primary and secondary sources for the study of important aspects of Islamic and Middle Eastern development.

Prerequisite, permission of instructor.

Credit, 4. Mr. Kirk.

750. RESEARCH SEMINAR IN HISTORY.

Training in historical research.

Prerequisite, permission of instructor.

Credit, 4.

751. SEMINAR IN MEDIEVAL HISTORY.

Training in historical research.

Prerequisite, permission of instructor.

Credit, 4. Mr. Lewis, Mr. Ware.

**752. SEMINAR IN RENAISSANCE AND
REFORMATION.**

Training in historical research.

Prerequisite, permission of instructor.

Credit, 4 each semester; total credit, 4. Mr. Ilardi.

753. SEMINAR IN THE ENLIGHTENMENT.

Training in historical research.

Prerequisite, permission of instructor.

Credit, 4. Mr. Greenbaum.

754. SEMINAR IN 18TH-CENTURY BRITAIN.

Training in historical research.

Prerequisite, permission of instructor.

Credit, 4. Mr. Wickwire.

755. SEMINAR IN MODERN ENGLISH HISTORY.

Research on selected topics, 1890-1940.

Prerequisite, permission of instructor.

Credit, 4. Mr. Hemon.

756. SEMINAR IN MODERN GERMANY.

Training in historical research.

Prerequisite, permission of instructor.

Credit, 4. Mr. Gordon.

757. SEMINAR IN MODERN FRANCE.

Training in historical research.

Prerequisite, permission of instructor.

Credit, 4.

758. SEMINAR IN RUSSIAN HISTORY.

Training in historical research.

Prerequisite, permission of instructor.

Credit, 4. Mr. McNeal.

**759. SEMINAR IN EUROPEAN DIPLOMACY
SINCE 1815.**

Training in historical research and an introduction to the relationships among European nations in a critical period.

Prerequisite, permission of instructor.

Credit, 4. Mr. Swartz.

761. SEMINAR IN EARLY AMERICAN HISTORY.

Training in historical research.

Prerequisite, permission of instructor.

Credit, 4. Mr. Bernhard.

**762. SEMINAR IN THE AGE OF JACKSONIAN
DEMOCRACY.**

Training in historical research.

Prerequisite, permission of instructor.

Credit, 4. Mr. Richards.

**763. SEMINAR IN THE CIVIL WAR AND
RECONSTRUCTION.**

Training in historical research.

Prerequisite, permission of instructor.

Credit, 4. Mr. Oates.

**764. SEMINAR IN THE WESTWARD
MOVEMENT OF THE UNITED STATES.**

Training in historical research.

Prerequisite, permission of instructor.

Credit, 4. Mr. Depillis, Mr. Davis.

**765. SEMINAR IN THE PROGRESSIVE ERA
IN THE UNITED STATES.**

Training in historical research.

Prerequisite, permission of instructor.

Credit, 4. Mr. Quint.

**766. SEMINAR IN THE UNITED STATES
BETWEEN THE WORLD WARS.**

Training in historical research.

Prerequisite, permission of instructor.

Credit, 4. Mr. Quint.

**767. SEMINAR IN AMERICAN DIPLOMATIC
HISTORY.**

Training in historical research.

Prerequisite, permission of instructor.

Credit, 4. Mr. Hart.

**768. SEMINAR IN AMERICAN INTELLECTUAL
HISTORY TO THE CIVIL WAR.**

Training in historical research.

Prerequisite, permission of instructor.

Credit, 4. Mr. Quint, Mr. Cantor.

**769. SEMINAR IN AMERICAN INTELLECTUAL
HISTORY SINCE THE CIVIL WAR.**

Training in historical research.

Prerequisite, permission of instructor.

Credit, 4. Mr. Quint.

770. SEMINAR IN THE COLONIAL HISTORY OF LATIN AMERICA.

Training in historical research.

Prerequisite, permission of instructor.

Credit, 4. Mr. Hanke.

771. SEMINAR IN ARGENTINE HISTORY.

Training in historical research.

Prerequisite, permission of instructor.

Credit, 4. Mr. Potash.

772. SEMINAR IN MEXICAN HISTORY.

Training in historical research.

Prerequisite, permission of instructor.

Credit, 4. Mr. Potash.

780. SEMINAR IN ISLAMIC AND MODERN MIDDLE EASTERN HISTORY AND POLITICS.

Training in historical research.

Prerequisite, permission of instructor.

A reading knowledge of a European language is highly desirable.

Credit, 4. Mr. Kirk.

800. MASTER'S THESIS.

Maximum credit, 8.

900. DOCTORAL DISSERTATION.

Maximum credit, 9.

COURSES OPEN TO BOTH GRADUATE AND UNDERGRADUATE STUDENTS

(For either major or minor credit)

500. THE ANCIENT WORLD TO 500 B.C.

From the origins of human society to the Greeks' confrontation with the Persian Empire.

Mr. Kirk.

501. THE ANCIENT WORLD: PERICLES TO CONSTANTINE.

The successive assertions and breakdowns of leadership in the Greek and Roman world.

Mr. Kirk.

502. EARLY MIDDLE AGES (300-1100).

Spread of Christianity; pagan and early Christian culture; Germanic kingship; the Carolingian world; early feudalism; monasticism and ecclesiastical centralization.

Mr. Lewis, Mr. Ware.

503. THE LATTER MIDDLE AGES (1100-1350).

Revival of towns and commerce; the growth and development of the feudal monarchies and ecclesiastical authority; rise of secularism.

Mr. Lewis, Mr. Ware.

505. LATE MIDDLE AGES AND EARLY RENAISSANCE (1300-1494).

The changes in European thought and institutions during the development of Humanism.

Mr. Ilardi.

506. LATE RENAISSANCE AND REFORMATION, 1494-1600.

The impact on the late Renaissance of the Protestant and Catholic Reformations.

Mr. Ilardi.

507. EUROPE IN THE ENLIGHTENMENT: 1685-1789.

Civilization of Western Europe in the 18th century, its social milieu, intellectual setting, institutional forces, religious tendencies, aesthetic contributions, and the growth of the revolutionary spirit.

Mr. Greenbaum.

508. THE FRENCH REVOLUTION AND NAPOLEON.

Political change in Europe from the Old Regime and the French Revolution to the fall of Napoleon.

509. HISTORY OF EUROPE: 1815-1870.

Major developments in the internal and international affairs of the European states from the Congress of Vienna to the Franco-German War.

Mr. Rearick.

510. EUROPE, 1870-1918.

Internal developments of the principal countries; conditions and diplomacy which led to the World War; military and diplomatic history of the war years.

Mr. vanSteenberg.

511. EUROPE SINCE 1918.

Major developments in the internal and international affairs of the European states since World War I.

Mr. vanSteenberg.

512. EUROPEAN INTELLECTUAL HISTORY IN THE 19TH CENTURY.

Chief intellectual currents in Europe; romanticism, liberalism, religious revival, socialism, Darwinism, racism, and mass culture.

Mr. Rearick.

513. EUROPEAN INTELLECTUAL HISTORY IN THE 20TH CENTURY.

Philosophical, academic, literary, aesthetic, political and popular currents since 1900.

Prerequisite, permission of instructor.

Mr. Johnston.

514 (I), 515 (II). THE HISTORY OF RUSSIA.

Political, economic, social, and intellectual development of Russia. First semester: Tsarist era; second: origins of Russian Marxism and the Soviet period. Either semester may be elected independently.

Credit, 3 each semester. Mr. Jones.

516. THE RUSSIAN REVOLUTION.

Intensive study of the origins, course, and impact of the Bolshevik Revolution.

Mr. McNeal.

517. SOVIET RUSSIA.

Major social, political, intellectual developments, and the international relations of Soviet Russia since the Bolshevik Revolution.

Mr. McNeal.

518. EARLY MODERN GERMANY.

From the end of the Thirty Years' War to the collapse of the Napoleonic hegemony.

Mr. Gordon.

519. THE HISTORY OF MODERN GERMANY.

The evolution and development of Germany since the Congress of Vienna; emphasis on diplomatic, political, military and social-economic trends and problems.

Mr. Gordon.

520. MODERN SCANDINAVIA.

The major issues of domestic and foreign politics of the states of Northern Europe in the 19th and 20th centuries.

Mr. van Steenberg.

521. FRANCE SINCE 1789.

Selected formative political crises from 1789 to the present, and their settings in the economic, social, and intellectual life of modern France.

Mr. Rearick.

522. IMPERIAL SPAIN: 1450-1810.

Early modern Spain from the time of Ferdinand and Isabella to the outbreak of the Spanish-American wars for independence, including the Habsburg and early Bourbon periods.

523. MODERN SPAIN: 1810 TO THE PRESENT.

Emphasizes economic, political, and cultural developments from the early 19th-century revolutions and the defeat of Napoleon to the age of Franco.

524. EUROPEAN DIPLOMATIC HISTORY: 1870-1914.

The internal politics and foreign policies of the major European powers. Emphasis on the themes of nationalism, liberalism, imperialism, alliance systems, and the origins of World War I.

Mr. Swartz.

525. EUROPEAN DIPLOMATIC HISTORY: 1914-1956.

The internal politics and foreign policies of the major European powers. Emphasis on the importance of World

War I, the polarization of national and international politics; the origins, course, and aftermath of World War II, and the post-war world. Mr. Swartz.

528. EUROPE IN THE AGE OF THE BAROQUE. Europe from the Wars of the Counter-Reformation to the Glorious Revolution. Civilization of the Baroque in its social, political, economic, religious and intellectual settings. Mr. Greenbaum.

529. SOCIAL HISTORY OF EARLY MODERN EUROPE. The social institutions of Europe as they changed from a system of feudal organization to pre-industrial society, including the evolution of the town to the city, the changing role of the church and agrarian life, and the development of an intellectual class. Mrs. Chrisman.

530. HISTORY OF MODERN ITALY. Survey of modern Italy from the risorgimento in the 18th century to the "opening to the left" of the 1960s, with particular reference to domestic problems after the unification, to Italian foreign policy up to the Second World War, and to the rise and consolidation of fascism. Mr. Sarti.

531 (I), 532 (II). ENGLISH HISTORY. Economic, social, and cultural influences, as well as constitutional development. Either semester may be elected independently. Credit, 3 each semester. Mr. Hernon, Mr. Shipley.

533. MEDIEVAL ENGLAND. England from the fifth to the fifteenth century, with attention to the Anglo-Saxon period, the Norman conquest, and the evolution of government to the accession of the Tudors. Mr. Ware.

534 (I), 535 (II), TUDOR-STUART ENGLAND: 1485-1688. Selected aspects of the constitutional, social, intellectual, and imperial history of England in this period. Either semester may be elected independently. Credit, 3 each semester. Mr. Shipley.

536. BRITAIN IN THE EIGHTEENTH CENTURY. Selected aspects of social, intellectual, imperial, and constitutional history including the Acts of Union. Impact of the Industrial and French Revolutions. Mr. Wickwire.

537 (I), 538 (II). MODERN BRITAIN. Selected topics on the political, social, and intellectual development of Britain in the nineteenth and twentieth centuries. Either semester may be elected independently. Credit, 3 each semester. Mr. Hernon.

539. HISTORY OF THE BRITISH EMPIRE AND COMMONWEALTH SINCE 1783. Evolution of British imperial policy; growth of the Dominions, the Commonwealth, and the dependent Empire; role of the Empire in world politics. Mr. Wickwire.

540. MILITARY HISTORY OF EUROPE, 1740-1914. Developments in military theory and practice, civil-military relations, technology; the armed forces as social and political institutions. Mr. Gordon.

541. MILITARY HISTORY OF EUROPE SINCE 1914. See History 540 for description.

601. HISTORY OF ARGENTINA (C). Argentina since the 18th century. Attention to political, social, and economic change and, in the 20th century, to the growing importance of labor and the military in politics. Mr. Potash.

602. THE HISTORY OF MEXICO. Mexico from the end of the 18th century to the present. Emphasis on political, economic, and social developments. Mr. Potash.

603. THE CARIBBEAN. The Caribbean as a focus of conflict and adjustment from the 15th century to the present. Mrs. Loy.

604. HISTORY OF GRAN COLOMBIA. Colombia, Venezuela, and Ecuador from colonial settlement to the present. Mrs. Loy.

605. HISTORY OF THE ANDEAN REPUBLICS. Peru, Bolivia, and Chile from the late colonial period to the present. Emphasis on political, social and economic developments; particular attention to institutions.

607. THE HISTORY OF THE PORTUGUESE EMPIRE. A survey of the colonial empire Portugal created in Morocco, West Africa, Mozambique, India, Brazil, and the Far East—from the capture of Ceuta in 1415 until Portugal recognized the independence of Brazil in 1825. Comparative treatment of economic affairs, political institutions, race relations, and cultural developments. Mr. White.

608. THE HISTORY OF BRAZIL. A general view of the cultural, economic, and political development of Brazil since 1822. How the largest and most populous nation in Latin America has become a significant power. Mr. White.

616. AMERICAN COLONIAL HISTORY TO 1783. Discovery and exploration, early European settlements, systems of political and economic control, religious and intellectual development. Anglo-French rivalry. Mr. Bernhard, Mr. Bell.

617. THE AMERICAN REVOLUTIONARY ERA. Coming of the Revolution; War for Independence; evolution of American federalism. Mr. Bernhard, Mr. Bell.

618. THE EARLY NATIONAL PERIOD, 1789-1828. Development of the United States in its formative years, emphasizing political, intellectual, and diplomatic factors. Mr. Bernhard.

619. JACKSONIAN AMERICA. Political, economic, and social developments in the period before the Civil War. Mr. Richards.

620. CIVIL WAR AND RECONSTRUCTION, 1860-1877. Conduct of the war; political problems; national reunification. Mr. Oates, Mr. Swenson.

621. THE GILDED AGE. The emergence of modern political issues during the final decades of the 19th century. Emphasis on the role of industrialization, corporate consolidation, urban growth, and labor, agrarian and genteel protest. Mr. McFarland.

624. THE PROGRESSIVE AGE (1900-1920). The political response to the changing economic and social conditions in American life. Mr. Thompson, Mr. Tager.

625. THE UNITED STATES BETWEEN THE WORLD WARS. American political, economic, and intellectual life between the two World Wars. Mr. Griffith, Mr. Wyman.

626 (I), 627 (II). HISTORY OF AMERICAN THOUGHT AND CULTURE. The basic strands of American thought and their reflection in American culture. First semester deals with the

period before 1865. Either semester may be elected independently.

Mr. Quint, Mr. Cantor, Mr. Boyer, Mr. Nissenbaum.

628. UNITED STATES CONSTITUTIONAL HISTORY TO THE CIVIL WAR.

Origins and development of American constitutionalism from the 17th century to the outbreak of sectional armed conflict.

Mr. Cantor.

629. UNITED STATES CONSTITUTIONAL HISTORY FROM THE CIVIL WAR TO THE PRESENT.

Evolution of constitutional power in modern America.

Mr. Cantor.

630 (I), 631 (II). SOCIAL HISTORY OF THE UNITED STATES.

The evolving status of individuals and groups and problems of migration, livelihood, urbanization, and social conflict. Either semester may be elected independently.

Mr. DePillis.

632. THE SOUTH IN AMERICAN HISTORY.

From early settlement to contemporary regional problems.

Mr. Thompson.

633. HISTORY OF AMERICAN WESTWARD EXPANSION: 1763-1893.

Advance of settlement from the Appalachians to the Pacific and the influence of the frontier upon social, economic, and political conditions.

Mr. Davis, Mr. DePillis.

634 (I), 635 (II). DIPLOMATIC HISTORY OF THE UNITED STATES.

Development of American foreign relations, 1776 to the present. Either semester may be elected independently.

Mr. Hart, Mr. Pelz.

636. HISTORY OF THE AMERICAN LABOR MOVEMENT.

Evolution of the trade unionism in American life from late 18th century origins through post-Civil War developments to the present. Critical evaluation of changes in labor history.

Mr. Laurie.

637. THE CITY IN THE MODERN UNITED STATES.

The industrial city and the full-scale urbanization of the modern United States. The effect of city life upon the social, political, and economic institutions of America. Emphasis on the historical origins of the problems of modern urban existence.

Mr. Tager.

638. AFRO-AMERICAN HISTORY.

African background of the black man, origins and progress of slavery in colonial America and the United States, development of Afro-American culture, and distinctive contributions of the black man to United States history.

639. UNITED STATES SINCE PEARL HARBOR.

Emphasis on political, economic, and social currents since World War II.

Mr. Griffith, Mr. Wyman.

640. CIVILIZATION OF ISLAM.

From the "revolutionary idea" of Islam and its conquest of an Arab empire to 18th-century decay and the Western challenge.

Mr. Biddle.

641. THE MODERN MIDDLE EAST.

From the impact of 18th-century Europe on the Islamic empire to the emergence of 20th-century nationalism, and socialism and the decline of Western influence.

Mr. Kirk.

642. THE OTTOMAN EMPIRE.

Ottoman history and institutions from the origins of the state to the proclamation of the Turkish Republic, ca. 1280 to 1923. Emphasis on political, economic, and social history and the problems of westernization.

660. HISTORY OF MODERN CHINA: THE 19TH CENTURY.

The nature of the "traditional" Chinese order inherited by China's alien Manchu rulers; China's response to the West; rise of rebellions; failure of conservative reform; disintegration of an ancient civilization.

Mr. Drake.

661. HISTORY OF MODERN CHINA: THE 20TH CENTURY.

Twentieth-century China's revolutions—intellectual, social, economic, political—and their settings, up to the present.

Mr. Drake.

662. HISTORY OF JAPANESE CIVILIZATION.

The development of Japanese civilization from its origins to the mid-nineteenth century.

Mr. Minear.

663. HISTORY OF MODERN JAPAN.

Japan's modernization from the mid-19th century.

Mr. Minear.

670 (I), 671 (II). HISTORY OF SCIENCE.

Development of major scientific achievements from antiquity to the present. Emphasis on scientific theory; conceptual developments are treated in philosophical, cultural, sociological, and scientific contexts.

Prerequisite, one year of physical science.

Home Economics

GRADUATE FACULTY

WILLIAM J. MELLEN, *Acting Dean of the School of Home Economics and Professor*, B.S., Massachusetts, 1949; M.S., Cornell, 1951; Ph.D., 1953.

ARNOLD FRIEDMANN, *Head of Department of Clothing and Interior Design and Professor*, B.F.A., Pratt Institute, 1953; M.S., Pratt Institute and New York University, 1960.

HELEN R. VAZNAIAN, *Head of Department of Community Services and Associate Professor*, B.S., State College, Framingham, 1946; M.Ed., Boston University, 1951.

ELLIS G. OLIM, *Head of Department of Human Development and Associate Professor*, B.A., Harvard, 1931; M.A., Roosevelt University, 1960; Ph.D., University of Chicago, 1965.

PETER L. PELLETT, *Head of Department of Human Nutrition and Associate Professor*, B.S., Borough Polytechnic, London, United Kingdom, 1952; Ph.D., London School of Hygiene and Tropical Medicine, 1956.

MARION A. NIEDERPRUEM, *Director of Graduate Studies in Home Economics and Professor*, B.S., University of New York, Buffalo, 1935; M.S., New York University, 1944; Ph.D., University of Michigan, 1956.

VIRGINIA A. BEAL, *Associate Professor*, B.S., Simmons College, 1939; M.P.H., Harvard School of Public Health, 1945.

MARK H. BERT, *Associate Professor*, B.S., Lima University, Peru, 1939; M.S., University of Illinois, 1948; Ph.D., 1955.

ROBERTA A. COLLARD, *Associate Professor*, B.S., University of Texas, 1940; Ph.D., University of Chicago, 1962.

GRACE J. CRAIG, *Assistant Professor*, B.A., University of Massachusetts, 1959; M.S., 1962; Ph.D., 1967.

GEORGE E. FORMAN, *Assistant Professor*, B.S., Louisiana State University, 1963; Ph.D., University of Alabama, 1967.

ALFRED L. KARLSON, *Assistant Professor*, B.A., Antioch, 1964; M.Ed., Tufts, 1966; Ph.D., University of Chicago, 1971.

BRUCE R. MORRIS, *Professor*, B.A., Western Reserve University, 1931; M.A., Ohio State, 1932; Ph.D., University of Illinois, 1937.

HERBERT S. PASTON, *Associate Professor*, B.F.A., Philadelphia College of Arts, 1952; M.A., Columbia, 1956; Ph.D., 1970.

BARBARA F. TURNER, *Assistant Professor*, B.A., Antioch, 1962; M.A., DePaul University, 1965; Ph.D., University of Chicago, 1969.

A Master of Science degree may be earned through the School of Home Economics by candidates who hold an accredited baccalaureate degree and are accepted under the general regulations of the Graduate School of the University. In addition scores in verbal and quantitative ability on the Graduate Record Examination and/or scores on the Miller Analogies Test must be submitted.

PLEASE NOTE: The various curricula of the School of Home Economics are undergoing revision and are expected to be changed greatly in the near future. Please consult the School for changes currently planned in the program in which you are interested.

Emphasis may be selected from the Department of Home Economics Education; Human Development; Nutrition and Food; and Textiles, Clothing, and Environmental Arts. If the general baccalaureate degree is not in Home Economics, adequate concentration and studies basic to the areas of emphasis must be made prior to admission. More specifically, the following prescribed academic backgrounds are suggested: Human Development—strength in the biological and social sciences; Nutrition and Food—depth in the physical and biological sciences; Textiles, Clothing and Environmental Arts—background in the social sciences; Home Economics Education—substance in the biological and social sciences.

For emphasis in Human Development, the baccalaureate degree need not be in human development nor in any related area such as child development, psychology, sociology or education. Human development includes options for the student to specialize in child development, adult development, aging and early childhood education. The department operates a laboratory school.

ALL COURSES CARRY 3 CREDITS UNLESS OTHERWISE SPECIFIED

Home Economics Education (HEEd.)

COURSES OPEN TO GRADUATE STUDENTS ONLY

(For either major or minor credit)

700. SPECIAL PROBLEMS IN HOME ECONOMICS EDUCATION.

Credit, 3–6. Miss Vaznaian.

UNIVERSITY OF MASSACHUSETTS

710. SEMINAR.

Readings, reports and discussions on the current literature in the area of Home Economics Education.

Credit, 1–3; maximum credit, 6. Miss Vaznaian.

800. MASTER'S THESIS.

Individual research. *Credit, 6–10. Miss Vaznaian.*

COURSES OPEN TO BOTH GRADUATE AND UNDERGRADUATE STUDENTS

(For either major or minor credit)

681. ADULT EDUCATION IN HOME ECONOMICS.

Organization of material, and selection, use, and evaluation of teaching techniques suited to group work with adolescents and adults. Credit toward meeting state standards for teachers and A.D.A. requirements.

Prerequisite, minimum of 6 credits in major area.

682. CURRICULUM AND METHODS IN HOME ECONOMICS.

Organization, scope, and sequence of learning experiences in home economics education. Philosophy and content of curriculum, development of resource units, and methods of teaching.

Prerequisites, Psych 601, 563, and Educ 251. *Credit, 4.*

Human Development (Hum Dev)

COURSES OPEN TO GRADUATE STUDENTS ONLY

(For either major or minor credit)

700. SPECIAL PROBLEMS IN HUMAN DEVELOPMENT.

Credit, 3–6.

710. SEMINAR.

Readings, reports and discussions on the current literature in the area of Human Development. *Credit, 1–3.*

800. MASTER'S THESIS.

Individual research.

Credit, 6–10.

COURSES OPEN TO BOTH GRADUATE AND UNDERGRADUATE STUDENTS

(For either major or minor credit)

570. CHILD DEVELOPMENT.

The child from the developmental point of view. Emphasis on interaction of heredity and environment on development.

Prerequisites, Soc 101, Psych 101, or permission of instructor.

572. DIRECTED LABORATORY SCHOOL OBSERVATION.

Directed experience in observation techniques with laboratory school children.

Prerequisite, HUM DEV 570 or equivalent. *Mrs. Craig.*

610. LANGUAGE AND COGNITIVE DEVELOPMENT.

Language and cognition from the developmental point of view. Emphasis on the relationship between language and thought and changes in that relationship in the course of cognitive growth.

Prerequisite, HUM DEV 570 or equivalent. *Mr. Olim.*

650. RESEARCH METHODS IN HUMAN DEVELOPMENT.

Methods and techniques for studying developmental processes at various stages of the life span, from infancy to old age.

Prerequisite, HUM DEV 570 or equivalent, or concurrently with HUM DEV 570. *Mrs. Craig.*

660. THEORIES OF HUMAN DEVELOPMENT.

The major theories of human development. Emphasis on psychological theories and concepts. The relevance and

relationship of biological, social and anthropological concepts.

Prerequisite, HUM DEV 570 or equivalent.

Miss Collard.

680. HUMAN DEVELOPMENT IN ADULTHOOD.

Human development from young adulthood through old age. A social psychological perspective of change across the adult life span.

Prerequisite, HUM DEV 270 or equivalent, or permission of instructor.

Mrs. Turner.

681. LABORATORY SCHOOL MANAGEMENT.

Principles and methods of early childhood education. Includes teaching methods and curriculum planning for two- to five-year-old children.

Prerequisites, HUM DEV 570 or equivalent.

682. PHILOSOPHY AND THEORIES OF EARLY CHILDHOOD EDUCATION.

Philosophy, theories, and history of early childhood education. Field trips.

Prerequisite, HUM DEV 681 or permission of instructor.

Miss Collard.

683. STUDENT TEACHING IN THE LABORATORY SCHOOL.

Students plan, direct, and teach curriculum in the laboratory school under staff supervision.

Prerequisite, HUM DEV 570 or permission of instructor.

684. INTERNSHIP IN A CHILD-SERVING PROFESSION.

Teaching or work with normal or exceptional children, Headstart children, or the emotionally disturbed.

Prerequisite, HUM DEV 570 or permission of instructor.

Nutrition and Food (NF)

See course descriptions on p. 164.

Textiles, Clothing and Environmental Arts (TCEA)

COURSES OPEN TO GRADUATE STUDENTS ONLY

(For either major or minor credit)

700. SPECIAL PROBLEMS.

Credit, 3-6.

710. SEMINAR.

Readings, reports and discussions on the current literature in the area of Textiles, Clothing and Environmental Arts.

Credit, 1-3; maximum credit, 6.

800. MASTER'S THESIS.

Individual research.

Credit, 6-10.

COURSES OPEN TO BOTH GRADUATE AND UNDERGRADUATE STUDENTS

(For either major or minor credit)

533. HISTORY OF DECORATIVE ARTS.

Style periods in their historic contexts with emphasis on developments in furniture and furnishings. Illustrated lectures. Study tours.

Prerequisite, TCEA 125 or permission of instructor.

565. HISTORY OF COSTUME.

Western costume from ancient civilization to the present; the relationship of clothing to the period. Study tours.

Prerequisite, TCEA 125.

629. ADVANCED INTERIOR DESIGN.

Advanced color theory; scale drawing, perspective drawings and renderings; investigation of sources and resources for interior designers and work problems in domestic and commercial interiors. Study tours.

One class hour, four studio hours.

Prerequisite, permission of instructor.

Mr. Friedmann.

642. TEXTILES.

Analysis and evaluation of recent scientific and technical developments in fibers and finishes.

Prerequisite, TCEA 240.

661. APPAREL DESIGN.

Patterns and fitting problems; development and use of master pattern in executing original designs.

One class hour, two 2-hour laboratories.

Prerequisite, TCEA 259, or permission of instructor.

Industrial Engineering and Operations Research

GRADUATE FACULTY

RICHARD W. TRUESWELL, *Head of the Department of Industrial Engineering and Operations Research and Professor, M.E.*, Stevens Institute of Technology, 1952; M.S.I.E., 1958; Ph.D., Northwestern, 1964.

ROBERT D. DAVIS, *Director of Graduate Studies in Industrial Engineering and Operations Research and Associate Professor, B.S.*, Trinity College, 1956; Ph.D., Northwestern, 1968.

JOSEPH L. BALINTFY, *Professor of General Business and Finance.*

WILLIAM J. DUFFY, *Associate Professor, B.S.*, University of Michigan, 1955; M.S., 1969; Ph.D., 1971.

RICHARD J. GIGLIO, *Associate Professor, B.S.*, Massachusetts Institute of Technology, 1959; M.S., Stanford, 1964; Ph.D., 1966.

FRANK C. KAMINSKY, *Associate Professor, B.S.*, University of Connecticut, 1961; M.S., Northwestern, 1964; Ph.D., 1965.

KLAUS E. KRONER, *Associate Professor, B.S.*, College of Wooster, 1949; B.S., New York University, 1957; M.S., American International College, 1961.

STANLEY LIPPERT, *Associate Professor, B.A.*, University of California, Los Angeles, 1935.

HUGH J. MISER, *Professor, B.S.*, Vanderbilt, 1938; M.A., Armour Institute of Technology, 1940; Ph.D., Ohio State, 1946.

ROBERT F. RIKKERS, *Associate Professor, B.S.*, Grinnell College, 1961; M.S., Northwestern, 1964; Ph.D., 1965.

EDWARD J. RISING, *Professor, B.M.E.*, Rensselaer Polytechnic Institute, 1950; M.M.E., Syracuse University, 1954; Ph.D., State University of Iowa, 1959.

RANDALL P. SADOWSKI, *Assistant Professor, B.S.*, Ohio University, 1965; M.S., 1967; Ph.D., Purdue University, 1971.

INDUSTRIAL ENGINEERING AND OPERATIONS RESEARCH

The graduate program in industrial engineering emphasizes the modern and analytical aspects of industrial engineering. Operations-research theory and applications are stressed, although not to the exclusion of traditional industrial engineering.

A Ph.D. in industrial engineering is offered in the major areas of operations research, manufacturing and production, and human-factors engineering. Mi-

nor areas of specialization are possible within the department in data processing and information-handling systems and in other areas outside the Department such as computer science, business administration, engineering (all majors), statistics, economics, and mathematics. The requirements for the Ph.D. degree are essentially as described in this catalog under general requirements for the Ph.D. degree.

A master's thesis is optional. If no thesis is written, a special project must be completed, bringing the minimum total number of credits required to 33 rather than 30 as under the thesis program.

The Department requires no foreign-language reading competency for the doctoral degree.

Additional information may be obtained by writing to the Head of the Department.

ALL COURSES CARRY 3 CREDITS UNLESS OTHERWISE SPECIFIED

COURSES OPEN TO GRADUATE STUDENTS ONLY

(For either major or minor credit)

700. SPECIAL PROBLEMS IN INDUSTRIAL ENGINEERING AND OPERATIONS RESEARCH.

Special projects in industrial engineering and/or operations research. Scope varied to meet specific conditions. Prerequisite as required by the problem. *Credit, 1-6.*

701. INDUSTRIAL ENGINEERING AND OPERATIONS RESEARCH.

A series of seminars on current, or recent, research conducted by faculty, graduate students, and/or invited lecturers. Required course for all Industrial Engineering and Operations Research graduate students regardless of background. *Credit, 1.*

720. LINEAR PROGRAMMING.

Theory and application of linear programming. Includes formulation of linear programming models, simplex, revised simplex and dual simplex algorithms, duality, parametric procedures, interpretation of results, and the decomposition principle. Prerequisite, permission of instructor.

Mr. Davis, Mr. Giglio, Mr. Rikkers.

722. TRANSSHIPMENT PROBLEMS AND DISCRETE PROGRAMMING.

Applications and solution techniques for transshipment and discrete programming problems; included are primal-dual algorithms for transshipment problems, primal and dual cutting plane, branch and bound, and heuristic algorithms for discrete programs.

Prerequisite, IE/OR 720 or equivalent.

Mr. Balintfy, Mr. Davis, Mr. Giglio, Mr. Rikkers.

724. NON-LINEAR AND DYNAMIC PROGRAMMING.

Theory and methods required to solve non-linear problems: Kuhn-Tucker theory, quadratic, separable and geometric programming, gradient techniques, and dynamic programming. Also methods of stochastic programming are surveyed. Formulations and applications are stressed and case examples are presented.

Prerequisite, IE/OR 720.

Mr. Davis, Mr. Giglio, Mr. Rikkers.

726. OPERATIONS RESEARCH APPLICATION.

Introduction to the practice of operations research. Cases from the literature, the instructor's experience, and backgrounds of government, industry, and education. Field work on an actual case.

Prerequisites, IE/OR 680, 720 (concurrent), or permission of instructor.

Mr. Giglio, Mr. Miser.

728. RECENT DEVELOPMENTS IN MATHEMATICAL PROGRAMMING.

In-depth study of the theory and/or application of recent developments in mathematical programming.

Prerequisites, IE/OR 722 and 724.

Mr. Davis, Mr. Giglio, Mr. Rikkers.

751. DESIGN FOR PRODUCTION.

The analysis of the factors and techniques, theoretical and practical, involved in the effective design of production systems.

Prerequisite, basic knowledge of statistics and operations research.

Mr. Sadowski.

752. MECHANIZATION AND AUTOMATION.

Investigation and analysis of the planning and control problems associated with the mechanization and automation of production systems.

Prerequisite, basic knowledge of the area.

Mr. Sadowski.

753. METHODS OF MEASUREMENT OF HUMAN WORK.

Analysis of physiological and/or psychological aspects of work situations. Learning, skilled performance, decision processes.

3 class hours, lectures and projects.

Prerequisite, permission of instructor.

Mr. Duffy, Mr. Lippert.

754. ADVANCED TOPICS IN ENGINEERING ECONOMY.

An integrated treatment of elements of engineering economy, economics, accounting, finance and operations research to provide a unified background for economic decision-making.

Prerequisites, background in economics, engineering mathematics, and elementary probability theory.

Mr. Giglio.

755. QUALITY CONTROL AND RELIABILITY ENGINEERING.

Current methods and techniques in quality control and reliability will be developed and discussed with emphasis being placed on the application of these principles.

Prerequisite, IE/OR 572.

Mr. Rising, Mr. Sadowski.

756. ADVANCED TOPICS IN DATA PROCESSING.

Probability theory and information theory, components and operation of analog and digital computers, the analysis of large-scale data-processing systems as applied to the functioning of organizational control systems.

Prerequisite, IE/OR 556.

Mr. Trueswell.

757. HUMAN FACTORS DESIGN ENGINEERING.

Work on a topic related to the student's own interests, using human factors research techniques and information sources.

3 class hours, seminar and project.

Prerequisite, permission of instructor.

Mr. Duffy, Mr. Lippert.

758. DESIGN OF CLOSELY-CONFINED

MANNED-OPERATIONS STATIONS (OE 781).

Introductory anatomy and physiology; respiration, effects of various air composition and pressures on efficiency, console design, anthropometry, work place layout; design of controls, psychological and physiological effects of work in confined spaces; system design and allocation of function.

Three class hours, one 2-hour laboratory per week.

Prerequisite, IE/OR 757 or permission of instructor.

Credit, 4. Mr. Duffy, Mr. Lippert.

761. DATA PROCESSING SYSTEMS ANALYSIS AND DESIGN.

Analysis and design of small, medium, and large scale electronic data processing systems. Real-time systems applications currently in use and proposed in the data-processing areas as opposed to the scientific areas. Electronic data processing systems and their effect on industrial and other organizations.

Mr. Anderson, Mr. Trueswell.

762. COMPUTER METHOD FOR OPERATIONS RESEARCH/MANAGEMENT SCIENCE APPLICATIONS.

The development of computer systems to process data and implement algorithms in the operations research/management science literature. A project-oriented course; both technical and user-oriented manuals will be prepared for each project.

Prerequisites, IE/OR 722 or IE/OR 724 (concurrent) and facility with a scientific programming language such as FORTRAN IV. Mr. Kaminsky, Mr. Rikkers.

763. INFORMATION SCIENCE AND TECHNOLOGY.

The information searching tools and techniques available to scientific and industrial organizations. Individual and group behavior in using these techniques. Critical analyses of information searching and retrieval systems, both manual and automated.

Mr. Trueswell.

777. MANUFACTURING CONTROL.

A quantitative and qualitative analysis of decision-making techniques in manufacturing and production control. Techniques in areas such as scheduling, queuing, inventory control, and process control are studied, extended, and evaluated.

Prerequisites, basic knowledge of statistics, principles of operations research, and an elementary course in the field. Mr. Rising, Mr. Sadowski.

783. SIMULATION AND MONTE CARLO TECHNIQUE.

Theory and application of simulation to problems of interest to the Industrial Engineer. Students are expected to design, develop, test, and evaluate several different types of complex simulation models.

Prerequisites, IE/OR 572, 573. Mr. Sadowski and Staff.

784. STOCHASTIC PROCESSES IN INDUSTRIAL ENGINEERING I.

Application and theory of stochastic processes with primary emphasis on Markovian processes. Applications in inventory control, maintenance, and queuing theory.

Prerequisite, IE/OR 571. Mr. Kaminsky, Mr. Rikkers.

785. STOCHASTIC PROCESSES IN INDUSTRIAL ENGINEERING II.

Continuation of IE/OR 784; the study of Markov processes. Included are non-Markovian processes, regenerative stochastic processes, and imbedded Markov processes. Both theory and applications.

Prerequisite, IE/OR 784. Mr. Kaminsky, Mr. Rikkers.

786. DECISION ANALYSIS.

Decision problems involving the choice between alternatives when uncertainty is present. Emphasis on the practical applications of this method, rather than on the more abstract theory. Topics include the structure of a Decision Analysis problem, the assignment of necessary probabilities, and the assessment of the decision-maker's value structure.

791. SEMINAR IN OPERATIONS RESEARCH.

Current applications, research activities, and research problems in operations research. Advanced master's and Ph.D. students only.

Mr. Davis, Mr. Giglio, Mr. Kaminsky, Mr. Miser, Mr. Rikkers.

792. SEMINAR IN MANUFACTURING AND PRODUCTION.

Current application, research activities, and research problems in manufacturing and production. Advanced master's and Ph.D. students only.

Mr. Rising, Mr. Sadowski.

793. SEMINAR IN DATA-PROCESSING AND INFORMATION-HANDLING SYSTEMS.

Current applications, research activities, and research

problems in information-handling and data-processing systems. Advanced master's and Ph.D. students only.

Mr. Trueswell
Credit, 3-6

800. MASTER'S THESIS.

900. DOCTORAL DISSERTATION.

Maximum credit, 30

COURSES OPEN TO BOTH GRADUATE AND UNDERGRADUATE STUDENTS

(For either major or minor credit)

553. METHODS AND STANDARDS ENGINEERING.

The principles involved in the simplification of the work pattern and the design of the work place, and in the establishment of production standards.

Three class hours, one 3-hour laboratory period.

Prerequisite, IE/OR 271, previously or concurrently.

Credit, 4. Mr. Duffy, Mr. Kroner, Mr. Lippert

556. DATA PROCESSING AND INFORMATION HANDLING SYSTEMS.

Principles and applications of data-processing and electronic computer systems for use by industrial engineer as a management tool for control and decision making

Prerequisite, permission of instructor.

Mr. Burrill, Mr. Trueswell

641. HOSPITAL INDUSTRIAL ENGINEERING I.

Introduction to the application of industrial engineering techniques to hospital management. Emphasis on the institution of industrial engineering programs in hospitals and the choice of suitable projects. Guest lecturers

Mr. Rising

642. HOSPITAL INDUSTRIAL ENGINEERING II.

A projects course based upon material covered in IE/OR 641. A study is first made of previous industrial engineering projects in hospitals; each student then conducts a project of his own in a local hospital.

Prerequisite, IE/OR 641.

Mr. Rising

660. SAFETY ENGINEERING.

Occupational health and safety for industrial engineers. Especial attention directed towards requirements of the Occupational Safety and Health Administration of the Federal Government.

Mr. Lippert

675. JOB EVALUATION.

The principles used to determine an evaluation of all occupations in order to establish an equitable rating between them, to establish sound wage and salary policies.

Prerequisite, IE/OR 151.

Credit, 2. Mr. Duffy, Mr. Lippert.

676. TIME STUDY.

The principles involved in the establishment of production standards and their application in the management function of cost accounting, estimating, production control incentives, budgetary control.

Prerequisite, IE/OR 151 concurrently except for Business Administration majors.

Mr. Duffy, Mr. Lippert.

677. LAYOUT AND DESIGN OF INDUSTRIAL FACILITIES.

The principles applying to plant layout, materials handling, and plant location. Modes of layout presentations illustrated by means of a student project.

Prerequisite, IE/OR 151 or equivalent.

Mr. Kroner, Mr. Sadowski.

682. WORK SIMPLIFICATION.

The principles involved in the simplification of means of doing work and in the application and use of these principles.

One class hour, one 3-hour laboratory period.

Prerequisites, ME 568 and IE/OR 676 concurrently.

Credit, 2. Mr. Duffy, Mr. Lippert.

COURSES NOT FOR MAJOR CREDIT
No graduate credit for students majoring in
Industrial Engineering & Operations Research)

660. DESIGN OF MAN-MACHINE SYSTEMS I.
Introduction to principles of human-factors engineering,
anthropometric, physiological, and psychological data
sources. Data-gathering and analysis techniques useful
to designers and industrial engineers. Occupational
health and safety standards.
Three class hours include lectures, demonstrations, and
experiments. Project option. Mr. Duffy, Mr. Lippert.

661. DESIGN OF MAN-MACHINE SYSTEMS II.
Human factors data applications to design of equipment
and industrial urban and vehicle environment. Decision
processes, communication. Problems of layout in indus-
try, hospitals, etc. Involves more complex problem ap-
plications than IE/OR 260/560.

Three class hours include lectures, demonstrations, and
experiments.

Project option.
Prerequisite IE/OR 260/560 or permission of instructor.
Mr. Duffy, Mr. Lippert.

571. BASIC PROBABILITY FOR ENGINEERS.
Probability theory, including: sample spaces; discrete
and continuous random variables; functions of random
variables; marginal, conditional, and joint probability,
density and cumulative distribution functions and move-
ments.

Prerequisite, Math 124.
Mr. Davis, Mr. Giglio, Mr. Kaminsky, Mr. Rikkers.

572. PRINCIPLES OF ENGINEERING STATISTICS.
Statistical principles as applied to engineering problems
including hypothesis testing, estimation, analysis of vari-
ance, design of experiments, sampling plans, statistical
quality control.

Prerequisite, IE/OR 571. Mr. Kaminsky.

**573. INTRODUCTION TO SIMULATION
METHODS** (also listed as GB 573).

Introduction to the principles and methods of computer
simulation for the analysis and design of complex sys-
tems. Problems associated with developing valid and
meaningful conclusions from simulation experimentation.
Emphasis on experimental design, model validation and
verification, and analysis of results.

Prerequisite, IE/OR 571 and basic knowledge of
FORTRAN.

Mr. Kaczka, Mr. Rising, Mr. Balintfy, Mr. Sadowski.

**653. INDUSTRIAL-ENGINEERING
ECONOMICS I.**

Accounting tools used by the industrial engineer for
effective cost control and the economic operation of in-
dustrial enterprises.

Mr. Giglio, Mr. Kroner, Mr. Sadowski.

**654. INDUSTRIAL-ENGINEERING
ECONOMICS II.**

Intended for all technical personnel. Concepts and
techniques required to make sound economic decisions.
Topics include use of interest formulas, replacement
theory, scheduling algorithms, lease buy decisions, taxa-
tion and depreciation, decision-making under risk, fore-
casting and financing of projects in both the public and
private sections. Mr. Giglio, Mr. Kroner, Mr. Sadowski.

678. PRODUCTION PLANNING AND CONTROL.

Analysis of quantitative and qualitative techniques for
production planning and control with emphasis on their
application to various production systems.

Prerequisites, IE/OR 572, 680.

Mr. Kroner, Mr. Rising, Mr. Sadowski.

679. OPERATIONS RESEARCH I.

Deterministic models of operations research; structure
and formulation of decision models for planning and
operating systems and algorithms for the solution of

linear programs, network problems, integer programs,
and multi-stage decision problems. Credit not allowed
for students who have taken Management 253, 254.

Mr. Davis, Mr. Giglio, Mr. Kaminsky, Mr. Rikkers.

680. OPERATIONS RESEARCH II.

Stochastic operations research models including proba-
bilistic dynamic programming models, Markov chain
theory, inventory models, and queuing models. Credit
not allowed for students who have taken Management
253, 254.

Prerequisites, IE/OR 679 and IE/OR 571 or an equiva-
lent background in probability theory.

Mr. Davis, Mr. Giglio, Mr. Kaminsky, Mr. Rikkers.

Italian

(Non-degree program)

GRADUATE FACULTY

*ZINA TILLONA, Associate Chairman for Italian and
Professor of Italian, B.A., Hunter College, 1950;
M.A., Wellesley, 1951; D.M.L., Middlebury, 1960.*

*FRANK FATA, Assistant Professor of Italian, B.A.,
Columbia College, 1961; M.A., Johns Hopkins Uni-
versity, 1964; Ph.D., 1966.*

*SARA STURM, Associate Professor of Italian and
French, B.A., University of Minnesota, 1963; M.A.,
1965; Ph.D., University of North Carolina, 1967.*

THE MASTER OF ARTS IN TEACHING DEGREE PROGRAM

The Department of French and Italian in coop-
eration with the School of Education offers a pro-
gram of studies in Italian language and literature
and professional preparation in teaching leading to
the degree of Master of Arts in Teaching. A total of
36 semester hours are required for the degree, of
which 12 will be in Italian language and literature,
12 in professional preparation and 12 in electives
from both of these areas of study.

The course of studies for each student depends
in large part on his undergraduate preparation and
fluency in the Italian language. Programs are ar-
ranged on an individual basis for each incoming
student. The MLA Italian test for teachers and ad-
vanced students is administered early in the M.A.T.
program to enable the department to determine pro-
ficiency levels in all skills of Italian. The department
is then able to suggest credit or non-credit courses
to strengthen fluency.

Those seeking admission to this program should
possess a bachelor's degree with a major in Italian
and should have earned a cumulative average of 3.0
(on a 4-point scale) in the major. It would be to
the candidate's advantage to have traveled or stud-
ied in Italy. Candidates are expected to be fluent in
all aspects of the language. Undergraduate work
should have been undertaken in advanced grammar,
composition, and literature. Should a candidate be
deficient in Italian grammar or composition, he may
do work in this area once admitted to the program,
but such work may not be counted towards the
degree. Students transferring from other institutions
may be granted up to 6 semester hours towards the

M.A.T. Those who have completed state certification requirements will also be eligible for the M.A.T.

ALL COURSES CARRY 3 CREDITS UNLESS OTHERWISE SPECIFIED

COURSES OPEN TO BOTH GRADUATE AND UNDERGRADUATE STUDENTS

409. GRADUATE READING COURSE.

For graduate students preparing for their M.A. or Ph.D. No previous knowledge of Italian required. *No credit.*

550. ITALIAN CIVILIZATION.

The historical, literary, philosophic and artistic aspects of Italian civilization, aimed at an understanding of Italian life and culture.

601 (I), 602 (II). DANTE AND THE DUECENTO. Selections from the works of Dante and his contemporaries; intensive study of the *Divine Comedy*. Mrs. Sturm.

610. THE RENAISSANCE.

Literature of the 14th and 15th centuries: Petrarca, Boccaccio, Poliziano, Alberti, Sacchetti. Mrs. Sturm.

615. THE HIGH RENAISSANCE.

Literature of the late 15th and 16th centuries: Machiavelli, Castiglione, Ariosto, Tasso. Mr. Fata.

630. ITALIAN LITERATURE OF THE 18TH CENTURY.

Significant currents and authors from Goldoni to Alfieri.

635. NEO-CLASSICISM AND ROMANTICISM.

The works of Foscolo, Leopardi, and Manzoni. Mr. Fata.

640. MODERN THEATER.

Italian theater from Verga to the present. Miss Tillona.

645. MODERN POETRY.

Italian poetry from Carducci to the present with emphasis on hermetism. Miss Tillona.

650. MODERN ITALIAN NOVEL.

Development of the novel from Verga to the present. Miss Tillona.

690. SEMINAR IN ITALIAN LITERATURE.

Italian literature for advanced students. Subject of seminar announced the preceding semester.

Labor Relations

GRADUATE FACULTY

HARVEY L. FRIEDMAN, *Director of the Labor Relations and Research Center and Assistant Professor of Political Science*, J.D., Boston University, 1947.

SOLOMON BARKIN, *Professor of Economics*.

J. R. BEATTIE, *Associate Director of the Cooperative Extension Service*.

JOHN L. BLACKMAN, JR., *Associate Professor of Economics*.

TIM L. BORNSTEIN, *Associate Professor of Law and Industrial Relations*.

JOHN T. CONLON, *Associate Dean of Business Administration and Professor of Management*.

BRUCE G. LAURIE, *Assistant Professor of History*.

STANLEY M. MOSS, *Assistant Head of Department of Psychology and Association Professor of Psychology*.

RICHARD W. TRUESWELL, *Professor of Industrial Engineering*.

LABOR RELATIONS

Students admitted to the Master of Science in Labor Relations degree program must meet the admission requirements of the Graduate School. An undergraduate major in a social science or in business administration is a normal prerequisite to admission. Applicants for admission should ordinarily have completed introductory college courses in principles of economics, labor economics or labor problems, statistics, and sociology or psychology. Students may be admitted who are deficient in one or more of these courses, but such students will be required to remove any deficiencies without credit toward the M.S. degree. College-level courses that would be helpful, although not required, include industrial relations, government, and industrial engineering. A feature of the program requires all students to serve a summer internship between their first and second year and an assignment in the labor extension program conducted by the Institute for Labor Affairs.

Students will be required to take the following courses in order to qualify for this degree:

BA 751. Principles and Policies of Administration.

Econ 744. Labor Statistics.

History 636. History of the American Labor Movement.

Econ 743. Wage Theory and Wage Relationships.

Econ 741. Collective Bargaining.

Econ 747. Manpower Economics.

Labor Rel 710. Seminar in Labor Relations.

Labor Rel 700. Practicum in Labor Research.

One graduate course in the 500, 600, or 700 series in psychology; Political Science 624; sociology and/or industrial engineering, approved by the Director. In addition, students will be required to choose four electives, at least one of which must be selected from Labor Rel 764, Econ 742, 745, 641, 746, SBA 760 & 762.

Labor Relations and Research Center Course Offerings

700. PRACTICUM IN LABOR RESEARCH I AND II.*

Practical experience in empirical research problems gained by assignment to ongoing projects conducted by the Center. Periodic seminars on methodology.

* Required course.

Credit, 6. Mr. Brook.

710. SEMINAR IN LABOR RELATIONS.*

Current critical issues in the labor field, such as automation, "unemployment pockets," racial integration in unions. Based upon historical perspective, selected research and field work. A paper is required. Taken in second year.

* Required course.

Credit, 3. Mr. Friedman.

764. THE GOVERNMENT OF UNIONS.

The organization and structure of unions, management of union activity, and policies and practices of unions.

Credit, 3. Mr. Friedman.

777. LABOR RELATIONS IN THE PUBLIC SECTOR.

Labor relations for employees of federal, state, and local government including but not limited to educational employees, and professionals. Special attention to statutory requirements.

Credit, 3. Mr. Friedman.

School of Business Administration Course Offerings

564. WAGE AND SALARY ADMINISTRATION.
(See Management 534 under Business Administration.)

645. MANAGEMENT AND UNION RELATIONS II.
(See Management 645 under Business Administration.)
Prerequisite, Management 565.

751. ORGANIZATION THEORY *
(See Business Administration 751.)
* Required course.

761. SEMINAR IN PERSONNEL MANAGEMENT.
(See Business Administration 761.)
Prerequisite, Management 214.

762. MANAGEMENT OF INDUSTRIAL
RELATIONS.
(See Business Administration 762.)

763. SEMINAR IN INDUSTRIAL RELATIONS.
(See Business Administration 763.)
Prerequisite, Management 565.

892. LEGAL ASPECTS OF INDUSTRIAL AND
LABOR RELATIONS.
(See Business Administration 892.)

Department of Economics Course Offerings

542. LABOR LAW AND LEGISLATION.
(See Economics 542.)

641. ECONOMIC SECURITY.
(See Economics 641.)

645. HUMAN RESOURCES.
(See Economics 645.)
Prerequisite, Econ 126 or equivalent.

741. COLLECTIVE BARGAINING.*
(See Economics 741.)
* Required course.

743. WAGE THEORY AND WAGE
RELATIONSHIPS.*
(See Economics 743.)
* Required course.

745. LABOR DISPUTE SETTLEMENT.
(See Economics 745.)

746. COMPARATIVE LABOR MOVEMENTS.
(See Economics 746.)
Prerequisite, History 636.

747. MANPOWER DEVELOPMENT.*
(See Economics 747.)
* Required course.

Department of Psychology Course Offerings

580. SOCIAL PSYCHOLOGY.
(See Psychology 580.)
Prerequisite, Psych 101.

Department of Sociology Course Offerings

551. URBAN SOCIOLOGY.
(See Sociology 551.)
Prerequisite, Soc 101 or permission of instructor.

556. RACE RELATIONS.
(See Sociology 556.)

575. SOCIAL PROBLEMS.
(See Sociology 575.)

592. INTRODUCTION TO SOCIAL WELFARE.
(See Sociology 592.)

731. SOCIAL GERONTOLOGY.
(See Sociology 731.)
Prerequisite, Soc 257 or permission of instructor.

759. SOCIAL STRATIFICATION.
(See Sociology 759.)
Prerequisite, Soc 259, or permission of instructor.

785. COMPLEX ORGANIZATIONS.
(See Sociology 785.)

Department of Political Science Course Offerings

522. MASSACHUSETTS POLITICS.
(See Political Science 522.)
Prerequisite, Pol Sci 218 and either Pol Sci 219 or 220.

572. PUBLIC ADMINISTRATION.
(See Political Science 572.)

575. COMPARATIVE PUBLIC POLICY.
(See Political Science 575.)

590. CONSTITUTIONAL LAW.
(See Political Science 590.)

591. CIVIL LIBERTIES.
(See Political Science 591.)

622. THE LEGISLATIVE PROCESS.
(See Political Science 622.)

624. METROPOLITAN POLITICS.
(See Political Science 624.)
Prerequisite, Pol Sci 218 or permission of instructor.

719. POLITICS AND THE LEGISLATIVE
PROCESS.
Selected topics relating to American politics, political
parties, elections, and the legislative process.
Prerequisite, Pol Sci 518 or equivalent.

Department of History Course Offerings

624. THE PROGRESSIVE AGE: 1900-1920.
(See History 624.)

625. THE UNITED STATES BETWEEN THE
WORLD WARS.
(See History 625.)

630. SOCIAL HISTORY OF THE
UNITED STATES.
(See History 630.)

636. HISTORY OF THE AMERICAN
LABOR MOVEMENT.*
(See History 636.)
* Required course.

637. THE CITY IN THE MODERN
UNITED STATES.
(See History 637.)

Department of Industrial Engineering and Operations Research Course Offerings

752. MECHANIZATION AND AUTOMATION.
(See Industrial Engineering and Operations Research
752.)

753. METHODS OF MEASUREMENT OF HUMAN WORK.
(See Industrial Engineering and Operations Research 753.)
Prerequisites, IE 253 and 272 or equivalent.

Landscape Architecture and Regional Planning

GRADUATE FACULTY

PAUL N. PROCOPIO, *Acting Head of Department and Professor of Landscape Architecture*, B.S., Massachusetts, 1941; M.S., 1954.

JULIUS GY FABOS, *Director of Graduate Studies and Associate Professor of Landscape Architecture*, B.S., Rutgers, 1961; M.L.A., Harvard, 1964.

THEODORE S. BACON, JR., *Professor of Planning*, B.A., Amherst, 1942; M.C.P., Massachusetts Institute of Technology, 1956.

MORTON B. BRAUN, *Lecturer in Regional Planning*, B.A., Harvard, 1941; M.G.R., Massachusetts Institute of Technology, 1948.

ROBERT O. BRUSH, *Lecturer, North Eastern Forestry Research Unit*.

CARL A. CARLOZZI, *Associate Professor of Resource Planning*, Department of Forestry and Wildlife Management.

RICHARD J. COSTLEY, *Professor of Landscape Architecture*, B.S., Utah State, 1934; M.S., Illinois, 1936.

HUGH C. DAVIS, *Associate Professor of Resource Planning*, B.S., Rollins College, 1950; M.S., University of Michigan, 1955; Ph.D., 1960.

NICHOLAS T. DINES, *Assistant Professor of Landscape Architecture*, B.S., Michigan State, 1966; M.L.A., Harvard, 1968.

JOHN H. FOSTER, *Professor of Agricultural Economics*, Department of Food and Agricultural Economics.

BARRIE GREENBIE, *Associate Professor of Regional Planning*, B.S., Florida, 1953; M.S., Wisconsin, 1968; Ph.D., 1972.

TOM S. HAMILTON, JR., *Associate Professor of Landscape Architecture*, B.F.A., Illinois, 1950; M.S., Massachusetts, 1952.

BENJAMIN ISGUR, *Adjunct Professor of Resource Planning*, B.S., Massachusetts, 1933; M.S., 1935; Ph.D., 1940.

ROBERT L. KENT, JR., *Associate Professor of Landscape Architecture*, B.S., Michigan State, 1957; M.L.A., 1959.

GORDON S. KING, *Professor of Arboriculture and Park Administration*, B.S., Michigan State, 1941; M.S., Massachusetts, 1956.

JOHN H. MARTIN, *Assistant Professor of Architecture*, A.R.I.B.A., Brighton College of Art, 1956; Certificate, University College, London, 1960; M.L.A., Harvard, 1967.

HAROLD E. MOSHER, *Professor of Landscape Architecture*, B.S., 1942; B.L.A., 1947; M.L.A., Massachusetts, 1957.

ANDREW J. W. SCHEFFEY, *Professor of Regional Planning*, B.A., Haverford, 1951; M.S., Michigan, 1952; Ph.D., 1958.

HARRY E. SCHWARZ, *Lecturer in Regional Planning*, B.C.E., George Washington, 1954.

DAVID W. SEARS, *Assistant Professor of Regional Planning*, B.A., Cornell, 1964; M.P.A., 1966; Ph.D., 1971.

PAUL W. SHULDINER, *Professor of Civil Engineering*, Department of Civil Engineering.

ERVIN H. ZUBE, *Professor of Landscape Architecture*, B.S., Wisconsin, 1954; M.L.A., Harvard, 1959; F.A.A.R., American Academy in Rome, 1961.

THE MASTER OF LANDSCAPE ARCHITECTURE DEGREE PROGRAM

(Project & Site-Planning Option)

Students selecting this option obtain an education in landscape architecture which provides them with professionally-proficient tools and technical competency in the execution of the traditional responsibility of the profession—the design of outdoor spaces for social interaction. Students are exposed to a wide range of environmental-design problems related to the satisfaction of man's social and physical needs. Emphasis is on an understanding of the natural and social systems, their relationships to each other, and the manifestation of these relationships in physical forms. The majority of the studio work uses real problems and real issues involving contemporary man and the society of which he is a part.

THE MASTER OF REGIONAL PLANNING DEGREE PROGRAM (Public Policy Option)

In this option, planning is viewed broadly as an important part of the public decision-making process, and thus as integral to the formation and implementation of public policy. It is the purpose of this option to produce graduates capable of identifying the major problems of a region, and, in addition, with the ability to consider and evaluate a number of alternative approaches to these problems. A thorough knowledge of the political and administrative environment within which the planner must operate is essential. However, in addition to the political constraints which must be recognized, there are physical, economic, and social constraints which are often vitally important. Within the public policy option, the student may want to specialize in one of the developing sub-fields: Resource/Open Space Planning, Environmental Assessment, and New Town Planning.

MASTER OF LANDSCAPE ARCHITECTURE OR MASTER OF REGIONAL PLANNING DEGREE PROGRAM

(Landscape-Planning Option)

In this option, emphasis is on the physical aspects of planning, and particular attention is placed upon a region's physical-resource base as a major constraint and opportunity for planning. A thorough knowledge of natural processes is essential. Atten-

tion is also focused on problems of environmental assessment from the vantage point of both resource characteristics and resource users. The objective of this option is to produce planners capable of integrating physical-resource considerations into the planning process. This option will not prepare MLA students for all segments of state registration and licensing examination in Landscape Architecture.

THE MASTER OF LANDSCAPE ARCHITECTURE AND THE MASTER OF REGIONAL PLANNING DEGREE PROGRAMS

The degrees are conferred upon graduate students who have satisfactorily met the following requirements:

1. Work covering at least two years in residence, and a minimum internship in a public or private office of at least three months. Specific requirements concerning the nature of such practice are determined by the Department.

2. The earning of not fewer than 46 credits of which 28 shall consist of graduate level courses within the department, with specific exceptions at the discretion of the Department.

3. Preparation of a satisfactory thesis or terminal project.

4. The passing of a final examination, written and/or oral.

5. Recommendation by the Department of Landscape Architecture and Regional Planning to the Graduate School for the awarding of the degree and approval of the recommendation by the Dean of the Graduate School.

6. See additional requirements under the General Information section of this Bulletin.

ALL COURSES CARRY 3 CREDITS UNLESS OTHERWISE SPECIFIED

COURSES OPEN TO GRADUATE STUDENTS ONLY

Landscape Architecture

700. SPECIAL PROBLEMS. *Credit, 1-5.*

701. DESIGN PROBLEMS I.

Emphasis on the development of skills in site design. Deals with smaller-scale site-development problems, site analysis, program development, design process, and alternative methods of communication. Individual and team projects.

Prerequisite, Env Des 235, 236, & 615. *Credit, 1-5.*

702. DESIGN PROBLEMS II.

Essentially a problem-solving course, drawing upon techniques from landscape design, physical planning, and architectural design. Problems of varying scale and complexity. Current real world problems emphasized.

Prerequisite, Env Des 615. *Credit, 5.* Mr. Martin.

703. ECOLOGY AND PHYSIOGRAPHY.

Visual evaluation of plant associations as related to land form and environmental conditions. Field studies.

Mr. Mosher.

706. PRESENTATION.

Advanced visual communications techniques applicable to landscape architecture.

707. CONSTRUCTION.

Problems in landscape construction as related to general design.

Mr. Dines.

708. CONSTRUCTION.

Road alignment, computations, and advanced landscape construction.

Mr. Dines.

713, 714. SEMINAR.

Professional topics in landscape architecture.

Credit, 2 each semester.

731. ADVANCED DESIGN PROJECTS.

Advanced design projects.

Credit, 5. Mr. Dines.

737. PROFESSIONAL PRACTICE.

Professional office-management and procedures: ethics, commissions, contracts, responsibilities, specifications, and cost estimating.

Mr. Kent.

793, 794. SEMINAR.

Topics in environmental planning and design research and theory.

Credit, 2 each semester.

800. MASTER'S THESIS.

Credit, 8.

801. TERMINAL PROJECT.

Credit, 8.

Regional Planning

700. SPECIAL PROBLEMS.

Credit, 1-5.

711. WATER RESOURCES PLANNING.

Water resources planning as a part of environmental planning, the state of the art from technical and institutional viewpoints, the steps and components of the water resources planning process.

Mr. Schwarz.

743. LAND AND THE DEVELOPMENT OF COMMUNITIES.

Land and its use from ancient to modern times. Emphasis on the resource base and its importance as the intensity of land-use increases in the development of both rural communities and highly urbanized areas.

Mr. Bacon.

744. METROPOLITAN AND REGIONAL PLANNING.

The growth and decentralization of cities and the formation of metropolitan areas. Planning as applied to the metropolitan complex and for various types of regions.

Mr. Bacon.

751. PLANNING IN THE POLITICAL MOVEMENT.

Planning as a decision-making process, the attributes of the political and administrative environment within which planning takes place, and the implications of this environment for the planning process and the planner.

Mr. Sears.

753. RESOURCE POLICY AND THE PLANNING PROCESS.

National resource policy formation and the planning process at the local, state, and regional levels.

Mr. Scheffey.

758. ENVIRONMENTAL ADMINISTRATION.

Alternative administrative arrangements for dealing with problems of environmental management and control at various levels of government.

Mr. Scheffey.

775. PROJECTS IN PLANNING I.

Development of elementary planning and design methods, application in the planning of projects.

776. PROJECTS IN PLANNING II.

Development of advanced-level planning and design methods, application in the planning of projects.

Prerequisite, Reg Pl 775.

781. REGIONAL PLANNING STUDIO.

Preparation of regional-development plans based upon an interdisciplinary approach to the analysis and evaluation of regional problems and potentials.

Credit, 5.

Mr. Fabos, Mr. Carlozzi, Mr. Sears, Mr. Vertrees.

788. URBAN AND REGIONAL SIMULATION AND GAMING.

Purposes and characteristics of models, simulations, and games. Brief examination of several recent urban and regional planning models, in-depth examination of two or three. The model-building process. Mr. Sears.

795 (I), 796 (II). SEMINAR

Credit, 2 each semester.

800. MASTER'S THESIS.

Credit, 8.

801. TERMINAL PROJECT.

Credit, 8.

COURSES OPEN TO BOTH GRADUATE AND UNDERGRADUATE STUDENTS

Environmental Design

543. HISTORY AND THEORY I.

A broad survey of the history of the designed human environment, from the origins of human society into the Renaissance. Mr. Martin.

544. HISTORY AND THEORY II.

A broad survey of the history of the designed human environment, from the Renaissance to the present.

Mr. Fabos.

605. DYNAMICS OF HUMAN HABITATIONS.

The complex interactions between man and the physical environment. Borrows information and viewpoints from psychology, sociology, biology, ecology, ethology, art, architecture, and planning in an attempt to locate and demonstrate fundamental organizing principles in the human perception and use of space and their effect on interpersonal relations. Mr. Greenbie.

615. GRAPHIC COMMUNICATION II.

Current techniques used in the graphic communication of the analysis and solution of environmental-design problems, and the development of facility in the use of various media.

Prerequisite, Env Des 212.

Credit, 4.

628. APPLIED DESIGN.

The development of an approach embodying the application of theory and design principles to the solution of environmental design problems.

Prerequisites, 615 and 647.

Credit, 4. Mr. Dines, Mr. Kent.

647. THEORY I.

Basic physical and ecological principles to be considered in design and planning.

Mr. Costley, Mr. Fabos.

648. THEORY II.

Basic economic, social, and political principles to be considered in design and planning.

Mr. Greenbie, Mr. Scheffey, Mr. Sears.

Landscape Architecture

653. LAND FORM.

The manipulation of land surfaces and its graphic representation through topographical plans, cross sections, profiles, and models.

Prerequisite, Env Des 212. *Credit, 2.* Mr. Procopio.

656. CONSTRUCTION MATERIALS.

Materials used in landscape construction, their design potential and limitations.

Prerequisite, Ld Arc 653.

Mr. Martin.

668. OPEN-SPACE PLANNING AND DESIGN.

The relationship of open-space planning to city and regional planning; the various functions of open space; the problems of planning and designing parks and recreation areas to satisfy varying needs. Mr. Zube.

Regional Planning

545. METROPOLITAN TRANSPORTATION.

(See Business Administration 545.)

573. CITY-PLANNING HISTORY.

The historical aspects of changing land uses, the evolution of community form, and the development of urban areas. Mr. Bacon.

574. CITY PLANNING.

Planning techniques and legal tools for guidance and control of contemporary urban and metropolitan development. Special consideration of problems of land use, housing, transportation, and related urban elements.

Mr. Bacon.

602. ECOLOGICAL PRINCIPLES OF RESOURCE PLANNING.

(See Forestry 602.)

Prerequisite, permission of instructor.

Mr. Carlozzi.

677. URBAN PROBLEMS I.

Urban issues in the context of metropolitan and regional implications, changing functions and relationships of central cities and suburbs, housing, zoning, urban blight, employment, and industrial location, formulation of planning goals.

Mr. Braun.

678. URBAN PROBLEMS II.

Arterial systems, fiscal problems and capital problems, grant programs, local administrative organization, metropolitan and regional organization.

Mr. Braun.

Linguistics

GRADUATE FACULTY

SAMUEL JAY KEYSER, *Head of the Department of Linguistics and Professor*, B.A., George Washington University, 1956; B.A. Honors, Oxford University (Merton), 1958; M.A., Yale University, 1960; Ph.D., Yale University, 1962.

BARBARA HALL PARTEE, *Director of Graduate Studies in Linguistics, Associate Professor of Linguistics and Associate Professor of Philosophy*, B.A., Swarthmore College, 1961; Ph.D., Massachusetts Institute of Technology, 1965.

ADRIAN AKMAJIAN, *Assistant Professor*, B.A., University of Arizona, 1966; Ph.D., Massachusetts Institute of Technology, 1970.

JAMES E. CATHEY, *Assistant Professor of German*.
CHARLES E. CLIFTON, JR., *Associate Professor of Psychology*.

ROBERT P. CREED, *Professor of English*.

RICHARD A. DEMERS, *Assistant Professor*, B.A., Oregon State University, 1963; M.A., University of Washington, 1965; Ph.D., University of Washington, 1968.

DONALD C. FREEMAN, *Associate Dean of the Faculty of Humanities and Fine Arts and Professor*, B.A., Middlebury College, 1959; M.A., Brown University, 1961; Ph.D., University of Connecticut, 1965.

EDMUND L. GETTIER, III, *Professor of Philosophy*.

FRANK W. HENY, *Assistant Professor*, B.A., University of Leeds, 1957; P.C.E., University College of Rhodesia, 1965; Ph.D., University of California, Los Angeles, 1970.

JAMES T. HERINGER, *Assistant Professor, B.A., Harvard, 1965; Ph.D., Ohio State University, 1971.*
 FERENCE PARSONS, *Associate Professor of Philosophy.*
 THOMAS H. PETERSON, *Assistant Professor, B.A., University of Wisconsin, 1960; Ph.D., University of California, Los Angeles, 1971.*
 AUSTIN QUIGLEY, *Assistant Professor of English.*
 CARROLL R. REED, *Professor of German.*
 ROBERT A. ROTHSTEIN, *Associate Professor of Slavic Languages and Literatures.*

The Department of Linguistics offers graduate work leading to the Ph.D. degree; a number of students are also admitted for work leading to the M.A. degree. Students may concentrate their graduate work in any of the following standard areas: syntax, semantics, phonology, diachronic linguistics, formal foundations of linguistic theory, particular languages or language families, and prosody, metrics, and stylistics. It is expected that psycholinguistics and sociolinguistics will also form an integral part of the Department's offerings. The Department of Linguistics is responsible for the University's course offering in English as a Foreign Language. Graduate training in the Department of Linguistics is strongly oriented toward preparing students to carry on individual creative research as early as possible in their graduate careers, and the Graduate Program is set up so as to maximize close student-faculty contact. The requirements for the M.A. and Ph.D. degrees listed below are subject to periodic review, and students are therefore advised to consult with the Department to check for any changes in requirements.

THE MASTER OF ARTS DEGREE PROGRAM

Prerequisites for admission: A B.A. or B.S. degree in nearly any field of undergraduate study. The following undergraduate fields form a useful background to linguistics: anthropology, computer science, English, a foreign language or language family, logic, mathematics, philosophy, psychology, and sociology. A student may be required to make up deficiencies in undergraduate training before being admitted to regular status.

Program of study: Thirty credit hours of graduate work, in which the following courses would normally be included: Linguistics 701, Linguistics 702, Linguistics 502, and other core courses. Certain courses may be waived on the basis of previous work.

Examination and Thesis: A thesis is not required to complete the M.A. M.A. examinations will cover significant areas of graduate work in linguistics.

THE DOCTOR OF PHILOSOPHY DEGREE PROGRAM

Prerequisites for Admission: A B.A., B.S., or M.A. degree.

Program of Study: Forty-eight credits of graduate work, at least half of which consist of 700-level linguistics courses.

Language requirement: There is no formal language requirement in the Ph.D. program. (However, students are generally expected to be able to

read relevant journal articles in a foreign language.) Students are also strongly encouraged to carry out linguistic research on a foreign language as part of their graduate work.

Examinations: Ph.D. candidates must satisfy the general examination requirement by submitting two linguistic papers, embodying the student's original research, in two distinct areas of the discipline. A final oral examination is held after the doctoral dissertation is submitted.

Dissertation: A dissertation is required.

ALL COURSES CARRY 3 CREDITS UNLESS OTHERWISE SPECIFIED

COURSES OPEN TO GRADUATE STUDENTS ONLY

700. SPECIAL PROBLEMS.

Selected research problems in Linguistics *Credit, 1-12.*

701. INTENSIVE INTRODUCTION TO TRANSFORMATIONAL GRAMMAR.

An intensive introduction to the concepts of transformational grammar. Survey in depth of problems and methods of research, with emphasis on different types of linguistic evidence and argument.

Credit, 6. Mr. Heny, Mr. Akmajian.

702. SYNTAX.

Intensive study of syntactic problems, preparation for independent syntactic research.

Ms. Partee, Mr. Akmajian, Mr. Heny.

703. ADVANCED PHONOLOGY.

Detailed investigation of recent research in phonological theory. Emphasis on current critical issues of phonological theory.

Mr. Demers, Mr. Heny, Mr. Heringer, Mr. Keyser.

704. SYNTACTIC THEORY.

Advanced survey of problems in the syntax of natural language encountered in attempting to characterize formally the notion of "grammar of a natural language." Prerequisite, Ling 702 and permission of instructor.

Ms. Partee, Mr. Akmajian, Mr. Heringer.

706. STRUCTURE OF A NON INDO-EUROPEAN LANGUAGE.

The phonological and syntactic structures of some non-Indo-European language or group of languages. Topics vary from year to year.

May be repeated for credit. Mr. Heny, Mr. Peterson.

707. COMPARATIVE LINGUISTICS.

The procedures and methods for comparing and contrasting languages. Mr. Demers.

708. DIALECTOLOGY.

The geographical and cultural variations within a language; mapping of dialects; analysis and interpretation of dialect materials.

709. FORMAL FOUNDATIONS OF LINGUISTIC THEORY.

Formal systems in modern linguistic theory. Formal methods and results, including Godel's Result and Tarski's semantic conception of truth. Ms. Partee.

710. SEMANTICS AND GENERATIVE GRAMMAR.

A comprehensive survey of semantic problems in transformational-generative linguistics. Feature theory, generative semantics, performatives, interpretation of denial structures, the semantic theory of truth and the interpretation of language; the logic of human language.

Ms. Partee, Mr. Heny, Mr. Heringer.

712. PSYCHOLINGUISTICS.

An introduction to psycholinguistics: its theoretical foundations, methodology, and experimental techniques. Emphasis on the acquisition of language, child language

and linguistic universals, and learning and perceptual strategies.

Prerequisite, Ling 701, or permission of instructor.

713. LINGUISTICS AND LITERATURE.

The application of modern linguistics to literary analysis. Meter, style, and explication of text on the basis of linguistic criteria.

Mr. Freeman, Mr. Keyser.

714. CONTEMPORARY PHONETICS.

Phonetics and the theory of language. Universal phonetic alphabet, acoustic phonetics, perceptual phonetics, articulatory phonetics and distinctive features.

Prerequisite, Ling 701 or permission of instructor.

Mr. Demers, Mr. Henry.

715. THEORY OF GRAMMAR.

Survey and comparison of modern theories of language. Structural linguistics, stratificational grammar, scale-and-category grammar, transformational-generative grammar. The nature of linguistic evidence.

Prerequisite, Ling 701 or permission of instructor.

Mr. Freeman, Mr. Keyser, Mr. Henry.

752. ADVANCED SYNTAX.

An intensive review of current research in syntactic theory, with emphasis on individual student research in syntactic theory.

Prerequisite, Ling 702.

755. DIACHRONIC LINGUISTICS.

Topics from traditional historical linguistics restudied from the standpoint of transformational generative grammar: language change, relative chronology of sound changes, comparative method, internal reconstruction, and linguistic universals.

Prerequisite, Ling 701 and permission of instructor.

Mr. Demers, Mr. Keyser.

790. SEMINAR.

Presentation of current research topics and literature.

810. RESEARCH TUTORIAL: SYNTAX.

Intensive investigation of a previously unexplored topic in syntax under close faculty supervision. Topic varies from year to year.

820. RESEARCH TUTORIAL: PHONOLOGY.

Intensive investigation of a previously unexplored topic in phonology under close faculty supervision. Topic varies from year to year.

830. RESEARCH TUTORIAL: LINGUISTIC THEORY.

Intensive investigation of a previously unexplored topic in linguistic theory under close faculty supervision. Topic varies from year to year.

900. DOCTORAL DISSERTATION. *Credit, 30.*

COURSES OPEN TO BOTH GRADUATE AND UNDERGRADUATE STUDENTS

(For either major or minor credit)

501. GENERAL LINGUISTICS.

A comprehensive treatment of the field of linguistics. The nature of language. Some language universals. Phonology, syntax, and other aspects of modern language theory.

502. PHONOLOGICAL THEORY.

Introduction to the basic principles of phonological descriptions of natural languages: phonological rules, morpheme structure, distinctive features, phonological levels, and linguistic universals.

Prerequisite, Ling 501, 701, or permission of instructor.

Mr. Henry, Mr. Demers, Mr. Keyser.

503. INTRODUCTORY SYNTAX.

The methods of work and sentence, formation; the notions of grammaticality and of well-formed sentences.

Prerequisite, Ling 501. Mr. Peterson, Mr. Heringer

504. FIELD METHODS.

Methods of eliciting significant linguistic information in the field. How to work with an informant. Investigation with the aid of the informant, of the structure of an unfamiliar language and of specific analytical problem it presents.

Mr. Henry, Mr. Peterson

623. STUDY OF THE NATIVE LANGUAGE.

The relevance of linguistic theory and results of linguistics to the study of English. Issues of style, poetics, the teaching of English, and others.

Mr. Freeman, Mr. Keyser

COURSE OPEN TO BOTH GRADUATE AND UNDERGRADUATE STUDENTS

410. ENGLISH FOR FOREIGN STUDENTS.

No credit

Marine Sciences

GRADUATE FACULTY

CHARLES S. YENTSCH, *Director of the Marine Station and Professor of Marine Sciences*, B.S., University of Louisville, 1950; M.S., Florida State University 1953.

DAYTON E. CARRITT, *Professor of Marine Sciences* B.S., Rhode Island College, 1937; Ph.D., Harvard 1948.

CHARLES F. COLE, *Professor of Fisheries Biology*.

D. CRAIG EDWARDS, *Assistant Professor of Zoology*

WILLIAM E. HERONEMUS, *Professor of Civil Engineering*.

ROBERT E. LEVIN, *Assistant Professor of Food Science and Technology*.

WARREN LITSKY, *Director and Commonwealth Professor of Agricultural and Industrial Microbiology*

EDWARD A. PERRY, *Assistant Professor of Marine Sciences*, B.A., Dartmouth, 1964; Ph.D., Case Western Reserve, 1969.

GREGORY W. WEBB, *Associate Professor of Geology*

ROBERT T. WILCE, *Associate Professor of Botany*.

The interdisciplinary program in Marine Sciences leads toward the Master of Science degree, enabling the student to go directly into marine research or to continue work for the Ph.D. degree in one of the specialty fields. The program includes a core curriculum of biological, geological, and physical oceanography and a specialty option in Geology, Botany, Zoology, Microbiology, Fisheries, or Food Science and Technology. It is conducted on the Amherst campus, the Marine Station in Gloucester, and at selected coastal sites. The primary research emphasis is presently in estuarine and coastal waters.

Students entering the Marine Science program should have completed an undergraduate degree in science or engineering, normally including at least one year each of mathematics, physics, chemistry, and biology. Any deficiencies should be remedied in the first year of residence in the program, although such work would not receive graduate credit. Excep-

ions may be made in individual cases. Acceptance of the program involves admission to the Graduate School of the University and admission by the Interdisciplinary Committee in the Marine Sciences. Appropriate faculty members will serve as the students' advisers and supervise the studies and research in the various specialty options.

ALL COURSES CARRY 3 CREDITS UNLESS OTHERWISE SPECIFIED

Courses for Students in Other Programs

MARINE SCIENCE 525. INTRODUCTORY OCEANOGRAPHY.

A survey of the oceans and sea water, the substrate, marine life, and processes; oceanographic techniques. For students in engineering and others desiring a general knowledge of the sea. Interdepartmental Staff.

Core Courses

GEOLOGY 655. PHYSICAL OCEANOGRAPHY.

Physical properties of sea water and their variations; water masses and circulation; interactions between ocean and atmosphere; wave, tide and current dynamics; techniques of oceanographic study. Prerequisite, one year of college physics; calculus recommended. Mr. Perry.

GEOLOGY 752. GEOLOGICAL OCEANOGRAPHY.

Physical characteristics and geological processes of the ocean basins and margins, and their bearing on interpretation of geological history. Mr. Webb.

MARINE SCIENCE 501. BIOLOGICAL OCEANOGRAPHY.

Aspects of major planktonic and benthic marine taxa, including distribution, periodicity, and dominant ecological factors. Emphasis on shallow water organisms and habitats. Interdepartmental Staff.

Optional Specialty Courses

MARINE SCIENCE 530. CHEMICAL OCEANOGRAPHY.

The chemical properties of the ocean that influence and are influenced by marine physical, biological, and geological systems. The nutrient cycles; the carbon dioxide system; the density, chlorinity, salinity problem; the geological history of sea water; the age of the ocean; gas solubility and gas exchange processes and problems; trace element chemistries; chemistry and man's use of the ocean.

Prerequisites, one-year college-level chemistry, physics, and mathematics. Mr. Carritt.

MARINE SCIENCE 550. MICROBIAL ECOLOGY OF MARINE ENVIRONMENT.

The ecology, function, and importance of microorganisms in the marine environment including the underlying sediments; their role in the food chain and productivity of the seas and estuaries; and the factors influencing seasonal and geographical population dynamics. Prerequisites, general courses in biology, microbiology, and chemistry; and permission of instructor.

Credit, 2. Mr. Litsky.

MARINE SCIENCE 700. SPECIAL PROBLEMS IN OCEANOGRAPHIC TECHNIQUES. Credit, 1-6.

MARINE SCIENCE 710. TOPICS IN MARINE CHEMISTRY.

The present state and trends in a few segments of marine chemistry, selected by those enrolled. Reading

of contemporary literature and contact with visiting scientists. Enrollment limited to ten.

Prerequisite, graduate standing in a science or engineering department, or permission of instructor. Pre-enrollment interview requested. Mr. Carritt.

(Other optional courses are listed under the headings of the several cooperating departments.)

Mathematics and Statistics

GRADUATE FACULTY

HASKELL COHEN, *Acting Head of the Department and Professor*, B.A., University of Omaha, 1942; S.M., University of Chicago, 1947; Ph.D., Tulane, 1952.

SAMUEL S. HOLLAND, JR., *Director of Graduate Studies and Professor*, B.S., Massachusetts Institute of Technology, 1950; M.S., Chicago, 1952; Ph.D., Harvard, 1961.

MATHEMATICS

MARSHALL H. STONE, *George David Birkhoff Professor of Mathematics*, B.A., Harvard, 1922; M.A., 1924; Ph.D., 1926.

DONALD ADAMS, *Assistant Professor*, B.A., University of New England (Australia), 1965; Ph.D., Monash University, 1970.

STEPHEN I. ALLEN, *Assistant Dean of College of Arts and Sciences and Associate Professor*, B.A., Amherst College, 1937; M.A., Harvard University, 1946; Ph.D., University of Pittsburgh, 1963.

MARY KATHERINE BENNETT, *Associate Professor*, B.A., Albertus Magnus College, 1961; M.A. University of Massachusetts, 1965; Ph.D., University of Massachusetts, 1966.

JOSEPH T. BORREGO, JR., *Assistant Professor*, B.A., University of Florida, 1961; M.S., 1962; Ph.D., 1966.

AVIAD M. BROSHI, *Assistant Professor*, B.A., Harvard University, 1965; M.S., Chicago, 1966; Ph.D., Chicago, 1969.

DONALD E. CATLIN, *Associate Professor*, B.S., Pennsylvania State University, 1958; M.A., 1961; Ph.D., University of Florida, 1965.

CHAN-NAN CHANG, *Assistant Professor*, B.S., National Taiwan University, 1964; Ph.D., Notre Dame University, 1970.

YU W. CHEN, *Professor*, Ph.D., University of Goettingen, Germany, 1934.

EDWARD A. CONNORS, *Assistant Professor*, B.A., College of the Holy Cross, 1962; M.A., University of Massachusetts, 1964; Ph.D., University of Notre Dame, 1968.

THURLOW A. COOK, *Assistant Professor*, B.A., University of Rochester, 1961; M.A., University of Buffalo, 1963; Ph.D., Florida State University, 1967.

HELEN F. CULLEN, *Professor*, B.A., Radcliffe, 1940; M.A., Michigan, 1944; Ph.D., 1950.

DAVID J. DICKINSON, *Associate Professor*, B.A., University of Denver, 1942; M.A., Columbia, 1948; Ph.D., Michigan, 1954.

- MURRAY EISENBERG, *Associate Professor*, B.A., University of Pennsylvania, 1960; M.A., 1962; Ph.D., Wesleyan University, 1965.
- HANS R. FISCHER, *Professor*, University of Zurich, Matriculation, 1952; Ph.D., 1959.
- JOHN FOGARTY, *Associate Professor*, B.A., Harvard University, 1961; Ph.D., Harvard University, 1966.
- DAVID J. FOULIS, *Professor*, B.A., University of Miami, 1952; M.S., 1953; Ph.D., Tulane, 1958.
- MICHAEL A. GAUGER, *Assistant Professor*, B.S., University of Notre Dame, 1967; Ph.D., University of Notre Dame, 1971.
- ALAN GLEIT, *Assistant Professor*, B.A., Harvard, 1965; M.A., Stanford University, 1967; Ph.D., Stanford University, 1969.
- DAVID R. HAYES, *Professor*, B.A., Duke, 1959; Ph.D., 1963.
- JAMES H. HEDLUND, *Assistant Professor*, B.A., Cornell University, 1963; M.A., University of Michigan, 1965; Ph.D., 1968.
- DOUGLAS N. HERTZ, *Assistant Professor*, B.S., Massachusetts Institute of Technology, 1963; M.A., Brandeis University, 1965; Ph.D., 1967.
- NORMAN E. HURT, *Assistant Professor*, Ph.D., University of Chicago, 1967.
- HENRY G. JACOB, *Professor*, B.E., Yale, 1943; M.E., 1947; Ph.D., 1953.
- MELVIN JANOWITZ, *Professor*, B.A., University of Minnesota, 1950; Ph.D., Wayne State University, 1963.
- HARRY F. JOINER, II, *Assistant Professor*, B.A., Texas Christian University, 1965; M.S., Florida State University, 1966; Ph.D., 1968.
- RALPH JONES, *Assistant Professor*, B.A., University of Missouri, 1967; M.A., University of Missouri, 1968; Ph.D., University of Wisconsin, 1972.
- STEPHEN L. JONES, *Assistant Professor*, B.A., University of Texas, 1964; Ph.D., University of Wisconsin, 1967.
- ELEANOR KILLAM, *Assistant Professor*, B.S., New Hampshire, 1955; M.S., 1956; Ph.D., Yale, 1961.
- LARRY KING, *Assistant Professor*, B.S., Brooklyn College, 1963; M.A., University of Maryland, 1966; Ph.D., University of Maryland, 1968.
- GEORGE H. KNIGHTLY, *Associate Professor*, B.S., Tufts, 1956; M.S., Stanford, 1962; Ph.D., Stanford, 1965.
- HSU-TUNG KU, *Assistant Professor*, B.S., Taiwan Normal University, 1961; M.S., Tulane, 1964; Ph.D., 1967.
- MEI-CHIN KU, *Assistant Professor*, B.S., Taiwan Normal University, 1961; M.A., Syracuse University, 1964; Ph.D., Tulane University, 1967.
- ESAYAS G. KUNDERT, *Professor*, Diploma, E.T.H., Zurich, 1945; Ph.D., 1950.
- LORRAINE D. LAVALLEE, *Associate Professor*, B.A., Mount Holyoke, 1953; M.A., University of Massachusetts, 1955; Ph.D., University of Michigan, 1962.
- TENG-SUN LIU, *Associate Professor*, B.S., National Taiwan University, 1954; M.A., University of Pennsylvania, 1961; Ph.D., 1963.
- RICHARD MANDELBAUM, *Assistant Professor*, B.S., Rensselaer Polytechnic Institute, 1965; A.M., Princeton University, 1967; Ph.D., Princeton University, 1971.
- ERNEST MANES, *Assistant Professor*, B.S., Harvey Mudd College, 1963; Ph.D., Wesleyan University, 1967.
- LARRY N. MANN, *Professor*, B.A., University of Pennsylvania, 1955; M.A., 1956; Ph.D., 1959.
- WALLACE S. MARTINDALE, III, *Professor*, B.A., Amherst, 1952; M.A., University of Pennsylvania, 1954; Ph.D., 1958.
- ROBERT A. MCGUIGAN, *Assistant Professor*, B.A., Carleton College, 1964; Ph.D., University of Maryland, 1968.
- PETER NORMAN, *Assistant Professor*, B.A., Harvard College, 1965; Ph.D., University of Pennsylvania, 1971.
- CHARLES H. RANDALL, *Associate Professor*, B.S.M.E., Polytechnic Institute of Brooklyn, 1951; M.S., University of Pittsburgh, 1957; Ph.D., Rensselaer Polytechnic Institute, 1966.
- ELLEN E. REED, *Assistant Professor*, B.A., Gonzaga University, 1962; M.A., University of Colorado, 1964; Ph.D., 1966.
- ARUNAS RUDVALIS, *Assistant Professor*, B.S., Harvey Mudd College, 1965; M.A., Dartmouth College, 1967; Ph.D., 1969.
- DONALD F. ST. MARY, *Assistant Professor*, B.S., McNeese State College, 1962; M.A., University of Kansas, 1964; Ph.D., University of Nebraska, 1968.
- JON L. SICKS, *Assistant Professor*, B.A., Indiana University, 1961; Ph.D., 1965.
- DORIS S. STOCKTON, *Assistant Professor*, B.S., Douglass College in Rutgers University, 1945; M.S., Brown, 1947; Ph.D., 1959.
- ALBERT J. STOREY, *Assistant Professor*, B.A., Washington and Lee University, 1961; M.S., University of Miami, 1964; Ph.D., 1968.
- WAYMAN L. STROTHER, *Professor*, B.S., Alabama State, 1943; M.S., University of Chicago, 1949; Ph.D., Tulane, 1951.
- JIN CHEN SU, *Professor*, B.S., National Taiwan University, 1954; Ph.D., University of Pennsylvania, 1962.
- ROBERT W. WAGNER, *Acting Director of the Office of Institutional Studies and Professor*, B.A., Ohio, 1934; M.A., University of Michigan, 1935; Ph.D., 1937.
- JU-KWEI WANG, *Professor*, B.S., National Taiwan University, 1954; Ph.D., Stanford University, 1960.
- FRANK WATTENBERG, *Assistant Professor*, B.S., Wayne State University, 1964; M.S., University of Wisconsin, 1965; Ph.D., University of Wisconsin, 1968.
- GEORGE W. WHAPLES, *Professor*, B.A., Knox College, 1935; M.A., Wisconsin, 1937; Ph.D., 1939.

STATISTICS

- RAM C. DAHIYA, *Assistant Professor*, M.A., University of Delhi, 1964; M.S., University of Wisconsin, 1967; Ph.D., 1970.

DONALD GEMAN, *Assistant Professor*, B.A., University of Illinois, 1965; Ph.D., Northwestern, 1970.

JOSEPH HOROWITZ, *Assistant Professor*, B.S., Massachusetts Institute of Technology, 1962; M.S., University of Michigan, 1963; Ph.D., 1967.

ROBERT KLEYLE, *Assistant Professor*, B.A., Duquesne, 1960; M.S., Pittsburgh, 1962; Ph.D., Harvard, 1968.

ROBERT LEW, *Assistant Professor*, B.A., Yale, 1962; M.S., University of Michigan, 1964; Ph.D., 1970.

GAIL B. OAKLAND, *Professor*, B.A., University of Saskatchewan, 1933; M.A., Minnesota, 1939; Ph.D., University of Aberdeen, 1956.

WALTER ROSENKRANTZ, *Associate Professor*, B.S., University of Chicago, 1958; M.S., University of Illinois, 1959; Ph.D., 1963.

BERTHOLD SCHWEIZER, *Professor*, B.S., Massachusetts Institute of Technology, 1951; M.S., Illinois Institute of Technology, 1954; Ph.D., 1956.

MORRIS SKIBINSKY, *Professor*, B.S., City College of New York, 1948; M.A., University of North Carolina, 1951; Ph.D., 1954.

THE DOCTOR OF PHILOSOPHY DEGREE PROGRAM

Applications for admission to the Ph.D. program are carefully screened by a Departmental committee which makes the recommendations for admission and financial aid, taking into account the applicant's selection of courses, grades, letters of recommendation, GRE scores, and other data. Admission is highly selective, and there is no minimal set of courses or grades that will guarantee admission. Applicants are encouraged to submit additional data on their mathematical training, such as texts used and topics covered in courses, details of honors projects, individual reading, etc.

All doctoral aspirants must take the Ph.D. Written Qualifying Exam, normally before the end of their second year. The exam covers roughly the material through the basic courses 711-712, 721-722, 723-724, and 771-772. The Preliminary Comprehensive Exam required by the Graduate School is given as an oral exam on more advanced topics and is taken after the Written Qualifying Exam. The Department requires a reading knowledge of two of the following languages: French, German, and Russian, at the Graduate School's level 3: sufficient to understand mathematical journal articles in the language.

THE MASTER'S DEGREE PROGRAM IN MATHEMATICS

At least 18 semester credit hours in undergraduate mathematics beyond the content of differential and integral calculus are normally required of each entering master's candidate. A one-year course in modern algebra and a one-year course in advanced calculus would be desirable.

To earn a master's degree in mathematics, a student must:

(1) Earn 30 credits, at least 18 of which must be in courses numbered 700 or above, and which must include the courses 711 (Modern Algebra I), 721 (Complex Variables I), 723 (Real Variables I), and

771 (General Topology I) or their equivalent. No more than 9 of the 30 credits counted toward the master's degree may be taken outside the Department, of which 9 all must be graduate credits and 6 must be math-related.

(2) Pass the master's Written Qualifying Exam. Knowledge of the material through the level of 711, 721, 723, and 771 should be sufficient to enable the student to pass the exam. A student who has passed the Ph.D. Written Qualifying Exam will be deemed to have satisfied the exam requirement for the master's degree in mathematics.

While the student ordinarily works out his program in consultation with his adviser, the ultimate responsibility rests with the student. A master's candidate who has not completed the requirements for the master's degree at the end of his second year will not be permitted to enroll further in the Department.

THE MASTER'S DEGREE PROGRAM IN STATISTICS

Each entering graduate student in Statistics must have completed at least 18 semester credit hours in undergraduate statistics, or in mathematics beyond the content of differential and integral calculus. A one-year course in matrix algebra and a one-year course in advanced calculus would be highly desirable.

The candidate will consult with a member of the faculty in preparing a program of study. A total of 30 credit hours is required. All master's candidates must take the following courses: 705, 706, 707, 805, and 806, amounting to a total of 15 credit hours. Six credit hours may be used for remedial mathematics courses, *e.g.*, mathematics 611 and 625. Remedial courses beyond 6 hours of lower-level mathematics courses, *e.g.*, mathematics 173, 174, may be required without credit given (depending upon the student and at the discretion of the student's adviser). A minimum of 6 credit hours in mathematics is encouraged but not required. A maximum of 6 credit hours may be taken, subject to approval, in departments other than Mathematics and Statistics. At least 3 credit hours must be taken from statistics course offerings other than those required.

The candidate is expected to obtain experience in statistical applications. A minor role in consulting-work or an internship in an organization where statistics can be applied provides experience in this direction.

The Department requires the successful completion of a general written qualifying examination before the student takes the general oral examination prescribed by University regulations for the master's degree.

ALL COURSES CARRY 3 CREDITS UNLESS OTHERWISE SPECIFIED

COURSES OPEN TO GRADUATE STUDENTS ONLY MATHEMATICS COURSES

700. TOPICS COURSE.

Topics may be chosen from the fields of algebra, geometry, theory of functions, topology, and applied mathematics.

Prerequisite, permission of instructor.

Credit, 1-3.

701 (I), 702 (II). TOPICS IN ALGEBRA.

Basic topics in algebra.

Prerequisite, permission of instructor.

Credit, 1-3 each semester.

703 (I), 704 (II). TOPICS IN GEOMETRY.

Basic topics in geometry.

Prerequisite, permission of instructor.

Credit, 1-3 each semester.

705 (I), 706 (II). TOPICS IN ANALYSIS.

Basic topics in analysis.

Prerequisite, permission of instructor.

Credit, 1-3 each semester.

711 (I), 712 (II). INTRODUCTION TO MODERN ALGEBRA.

Groups, rings, algebras, fields, modules, linear transformations and matrices, tensor products, homological algebra.

Prerequisite, Math 212.

Credit, 3 each semester.

713. INTRODUCTION TO ALGEBRAIC NUMBER THEORY.

The basic theory of valuations, rings of integral elements, and ideal theory in algebraic number fields of algebraic functions of one variable, including Dirichlet-Hasse unit theorem and Riemann-Roch theorem for curves.

Prerequisite, Math 711-712 or equivalent.

714. QUADRATIC FORMS.

Quadratic spaces, the orthogonal group, the representation and equivalence of quadratic forms over arithmetic fields, the Hasse-Minkowski theorem, the integral theory of quadratic forms over arithmetic domains, the genus and the spinor genus.

Prerequisites, Math 711-712 and 713 or equivalents.

715 (I), 716 (II). CLASS FIELD THEORY.

Local class field theory, residues in fields of algebraic functions, global class field theory, generalized local class field theory, application to simple algebras and quadratic forms.

Prerequisite, Math 713.

Credit, 3 each semester.

721 (I), 722 (II). THEORY OF FUNCTIONS OF A COMPLEX VARIABLE.

Linear transformations of a complex variable, power series and elementary functions, holomorphic functions and Cauchy's Theorem, theory of residues, isolated singularities, conformal mappings, entire and meromorphic functions and their representations by means of products and partial fractions, elliptic functions, analytic continuation and Riemann surfaces, algebraic functions.

Prerequisite, Math 626.

Credit, 3 each semester.

723(I), 724 (II). THEORY OF FUNCTIONS OF A REAL VARIABLE.

The real number system, Lebesgue measure and the Lebesgue integral, differentiation and integration, the classical Banach spaces, abstract spaces, general measure and integration theory.

Prerequisite, Math 625.

Credit, 3 each semester.

725. INTRODUCTION TO FUNCTIONAL ANALYSIS.

Banach and Hilbert spaces, continuous linear operators, spectral theory, Banach algebras.

Prerequisites, Math 512 and 771 (co-requisite).

726. INTRODUCTION TO FUNCTIONAL ANALYSIS.

Continuation of Math 725. Topics from Banach algebra and representation theorems for Banach algebras; von Neumann algebras; analysis in Banach algebras, spectral theory; analytical theory of semigroups; vector lattices, Krein-Milman theorem.

731 (I), 732 (II). INTRODUCTION TO PARTIAL DIFFERENTIAL EQUATIONS.

Equations in mathematical physics, types of systems, characteristic manifolds, questions of uniqueness and existence, generalized derivatives.

Prerequisite, Math 626.

Credit, 3 each semester.

735. LATTICE THEORY I.

Partially ordered sets, lattices, modular lattices, Boolean algebras, representation theory for lattices.

Prerequisite, Math 512.

736. LATTICE THEORY II.

Continuation of Math 735. Stone's representation theorem for Boolean algebras, Loomis' representation theorem for Boolean sigma-algebras, introduction to the theory of orthomodular lattices and their coordinating Baer*-semigroups.

Prerequisite, Math 735.

745 (I), 746 (II). ADVANCED APPLIED MATHEMATICS.

Topics from engineering and mathematical physics presented rigorously and with free use of abstract mathematical concepts and modern mathematical machinery.

Prerequisite, permission of instructor.

Credit, 3 each semester.

771 (I), 772 (II). INTRODUCTION TO GENERAL TOPOLOGY.

Topological spaces, separation axioms, compactness, connectedness, metric spaces, product and quotient spaces, nets and filters, local properties, imbedding theorems, inverse limits, arcwise connectedness, arc theorems, indecomposable continua, introduction to homotopy theory and the fundamental group.

Prerequisite, Math 625.

Credit, 3 each semester.

773. ALGEBRAIC METHODS IN TOPOLOGY.

May be substituted for Math 772. Manifolds, fundamental group, covering spaces, applications to group and knot theory, higher homotopy groups and exact sequences.

Prerequisite, Math 771.

781. ALGEBRAIC TOPOLOGY I.

Homotopy theory, simplicial and Cech homology theories.

Prerequisites, Math 771, 711.

802. ALGEBRAIC TOPOLOGY II.

General homology theory, universal coefficient theorems, singular homology theories, ring structure in cohomology theories, spectral sequences, Steenrod operations.

Prerequisite, Math 781.

803. ALGEBRAIC TOPOLOGY III.

Presheaves and sheaves, sheaf cohomology, Cech cohomology, applications; deRham theorem; spectral sequences.

Prerequisite, Math 782.

811 (I), 812 (II). ADVANCED ALGEBRA.

Advanced topics in algebra.

Prerequisite, permission of instructor.

Credit, 3 each semester.

821 (I), 822 (II). ADVANCED COMPLEX ANALYSIS.

Advanced topics in complex analysis.

Prerequisite, permission of instructor.

Credit, 3 each semester.

823 (I), 824 (II). ADVANCED ANALYSIS.

Advanced topics in analysis.

Prerequisite, permission of instructor.

Credit, 3 each semester.

831 (I), 832 (II). ADVANCED ORDINARY OR PARTIAL DIFFERENTIAL EQUATIONS.

Advanced topics chosen from dynamic systems, differential operators with constant coefficients, hyperbolic and

elliptic operators, non-linear equations, asymptotic expansions.

Prerequisite, permission of instructor.

Credit, 3 each semester.

835. ADVANCED LATTICE THEORY I.

Advanced topics chosen from the fields of orthomodular lattices, quasi-orthomodular lattices, continuous geometries, complemented modular lattices, and their representation theories.

Prerequisite, Math 736.

836. ADVANCED LATTICE THEORY II.

Continuation of Math 835. One or more of the topics of Math 835 examined in detail up to the present frontiers of knowledge.

Prerequisite, Math 835.

852 (I), 852 (II). DIFFERENTIAL TOPOLOGY.

Differential manifolds, immersions and imbeddings; Whitney approximation theorems; vector bundles; tangent and normal bundles; characteristic classes and cobordism.

Prerequisites, Math 772 and 781.

Credit, 3 each semester.

853 (I), 854 (II). TOPOLOGICAL SEMIGROUPS.

Topics: from ideals in semigroups, Green's relations, Rees-Suschkewitch theorem, semigroup structures on continua, homomorphisms, irreducible semigroups, actions by semigroups, and other topics of current interest.

Prerequisites, Math 771-772 or equivalent.

Credit, 3 each semester.

861 (I), 862 (II). ADVANCED GEOMETRY.

Advanced topics in geometry.

Credit, 3 each semester.

871 (I), 872 (II). ADVANCED TOPOLOGY.

Advanced topics in topology.

Credit, 3 each semester.

881 (I), 882 (II). ADVANCED PURE AND/OR APPLIED MATHEMATICS.

Credit, 3 each semester.

883 (I), 884 (II). DIRECTED READINGS.

Credit, up to 6.

889 (I), 890 (II). PROBLEM SEMINAR.

Introduces beginning graduate students to the methods of mathematical research.

Credit, 1 each semester.

891 (I), 892 (II). PROSEMINAR.

Presentation by the beginning graduate student of material from the mathematics literature.

Credit, 1 each semester.

893 (I), 894 (II). LITERATURE SEMINAR.

Presentation by the intermediate graduate student of material from the mathematics literature.

Credit, 1 each semester.

895 (I), 896 (II), 897 (III), 898 (IV).

RESEARCH SEMINAR.
Presentation by the advanced graduate student of research articles, perhaps his own research.

Credit, 1 each semester.

900. DOCTORAL DISSERTATION. *Credit, up to 30.*

Statistics Courses

701 (I), 702 (II). STATISTICAL TEST AND DECISION PROCEDURES.

Statistical decision theory, theory of hypothesis testing, optimal tests, non-parametric procedures.

Prerequisites, Stat 707; Math 611 and 625, or equivalent.

Credit, 3 each semester.

705 (I), 706 (II). PROBABILITY THEORY FOR STATISTICS.

Experiments, sample spaces, probability measures, combinatorics, random variables, distribution functions, conditional probability, independence, derived distributions, moment generating functions, central limit theorem. Borel sets, measures, correspondence theorem, random

variables, expectations, product spaces, multivariate distributions, convolutions, weak and strong laws of large numbers, uniqueness theorem, central limit theorem. Radon-Nikodym theorem and the general concept of conditioning.

Prerequisites, Math 173, 174 or equivalent.

Prerequisite or corequisite, Math 625 or equivalent.

Credit, 3 each semester.

707. A FIRST COURSE IN MATHEMATICAL STATISTICS.

Distribution theory, maximum likelihood estimation, confidence intervals, sufficiency, point estimation, hypotheses testing, Bayesian inference, decision theory, nonparametric statistics, survey of special topics.

Prerequisite, Stat 705.

725 (I), 726 (II). ESTIMATION THEORY AND HYPOTHESIS TESTING.

Maximum likelihood, types of estimation, properties of estimators, 2 sample problem, k sample problem.

Prerequisites or corequisites, Stat 562 and 582; Math 611 and 625, or equivalent.

Credit, 3 each semester.

751. RANDOM PROCESSES I.

Foundation of the theory of random processes, stopping times, sample analysis, calculus in quadratic mean, spectral analysis; survey of various special processes and applications, e.g., Markov processes, random walks, queueing and renewal processes, Brownian motion, Ornstein-Uhlenbeck process, diffusion processes, stationary processes.

Prerequisites, Math 723 or Stat 705, 706 or Stat 851 or permission of instructor.

752. RANDOM PROCESSES II.

Topics from the following: modern theory of Markov processes and potential theory, martingale theory, stochastic integral and differential equations, stationary processes, ergodic and information theory; various applied areas, such as queueing theory, theory of dams, optimal stopping and decision problems, statistical analysis of time series.

Prerequisite, Stat 751.

805 (I), 806 (II). ADVANCED MATHEMATICAL STATISTICS.

Review and extension of 705, 706, 707. Characteristic functions and their properties, central limit theorems, matrix algebra and multivariate analysis, bounds for the variance. Sufficiency, completeness, efficiency, maximum likelihood, least squares, tests, interval estimation, multiple comparisons.

Prerequisites, Stat 706 and 707.

Credit, 3 each semester.

841 (I), 842 (II). RECENT DEVELOPMENTS IN STATISTICS.

Content varies with instructor. Possible topics include: inference in stochastic processes, decision processes, spectral analysis of stationary processes, geometry of moment spaces, sequential procedures, optimal stopping. Prerequisites, Stat 706 and 707, Math 611 and 625 or equivalent.

Credit, 3 each semester.

851 (I), 852 (II). ADVANCED PROBABILITY, I AND II.

Measure and integration, distribution and characteristic functions, Laplace transforms; laws of large numbers, central limit theorem; Radon-Nikodym theorem, conditioning. Topics from the following: the general central limit problem, classes of probability laws, domains of attraction; foundations of random processes, Kolmogorov consistency theorem, potential theory, ergodic and information theory.

Prerequisites, Math 723 or Stat 706 or permission of instructor.

Credit, 3 each semester.

880. SEMINAR.

Research papers by staff and students; invited lectures by prominent statisticians. *Credit, 1-3.*

COURSES OPEN TO BOTH GRADUATE AND UNDERGRADUATE STUDENTS

(For either major or minor credit)

Mathematics Courses

533. PROBABILITY.

A postulational study of probability, including counting methods, random variables; additional topics chosen from Bayes' Theorem, statistical independence, laws of large numbers, and Markov processes. *Coresquisite, Math 165, 166.*

541. APPLIED ANALYSIS I.

Complex analysis including analytic functions, residues, and conformal mappings; superposition of solutions of linear differential equations; orthogonal functions and Fourier series. *Prerequisite, Math 165, 166.*

542. APPLIED ANALYSIS II.

Continuation of Math 541. Properties of Fourier series; boundary value problems; orthogonal functions; Laplace and Fourier transforms; applications to physical and engineering sciences. *Prerequisite, Math 541; differential equations and a year of physics are desirable.*

545, 546. APPLIED MATHEMATICS I AND II.

Topics from engineering and mathematical physics presented rigorously and with free use of abstract mathematical concepts and modern mathematical machinery. *Prerequisites, Math 165, 166 and either Math 167 or Math 500. Credit, 3 each semester.*

551. NUMERICAL ANALYSIS I.

A first course in techniques of numerical approximation in analysis and algebra. *Prerequisites, Math 165, 166 and Comp Sci 121 or 131 or knowledge of basic Fortran.*

552. NUMERICAL ANALYSIS II.

Continuation of Math 551, including numerical solution of partial differential equations. *Prerequisite, Math 551.*

611. THEORY OF GROUP REPRESENTATIONS.

Abstract groups, subgroups, quotient groups, homomorphisms, representations, irreducible representations, characters, orthogonality relations. *Prerequisites, Math 167 and permission of the Department.*

612. ADVANCED TOPICS IN ALGEBRA.

Topics chosen from: rings, integral domains, modules over principal ideal domains, field extensions, and Galois theory. *Prerequisite, Math 611, or Math 511 and permission of instructor.*

613. THEORY OF NUMBERS.

Euclidean algorithm, prime numbers, congruences, quadratic reciprocity, further topics in number theory. *Prerequisite, Math 167 or Math 500 or permission of instructor.*

625. INTRODUCTORY MODERN ANALYSIS I.

Basic topology of Euclidean n -space and metric spaces, convergence of sequences and series, continuous functions and their local and global properties. *Prerequisites, Math 165, 166 and Math 167.*

626. INTRODUCTORY MODERN ANALYSIS II.

Continuation of Math 625. Differentiation, Riemann integration, sequences and series of functions, functions of several variables. *Prerequisite, Math 625.*

631. ORDINARY DIFFERENTIAL EQUATIONS.

First and second-order equations, existence and uniqueness theorems, systems of equations. *Prerequisites, Math 165, 166 and Math 167.*

632. TOPICS IN ORDINARY DIFFERENTIAL EQUATIONS.

Topics to be chosen from: Sturm-Liouville Theory, series solutions, stability theory and singular points, numerical methods, transform methods. *Prerequisite, Math 631.*

634. INTRODUCTION TO PARTIAL DIFFERENTIAL EQUATIONS.

Classification of second-order partial differential equations, wave equation, Laplace's equation, heat equation, separation of variables. *Prerequisites, Math 165, 166 and Math 631; Math 525 or Math 625 is also desirable.*

645. LINEAR ALGEBRA FOR APPLIED MATHEMATICS.

Introduction to vector spaces, inner products, and matrices; linear transformations, tensors, determinants, orientation, the spectral theorem for normal operators, complexification, real normal operators, and exterior algebra. *Prerequisite, Math 167.*

646. VECTOR AND TENSOR ANALYSIS WITH APPLICATIONS.

Continuation of Math 645. Frechet derivatives, the inverse and implicit function theorems, vector and tensor fields, exterior differentiation, differential forms, differentiable manifolds. *Prerequisites, Math 645 and Math 165, 166.*

663. DIFFERENTIAL GEOMETRY.

Differential geometry of curves and surfaces in Euclidean 3-space using vector methods. *Prerequisites, Math 167 and Math 165, 166.*

671. SET THEORY.

Basic properties of sets. Ordered sets. Complete ordered sets. Well-ordered sets. Cardinal and ordinal numbers. Axiom of choice, well-ordering theorem, and Zorn's lemma. Cardinal arithmetic. *Prerequisite, permission of instructor.*

Statistics Courses

561. ADVANCED STATISTICAL ANALYSIS OF EXPERIMENTAL DATA (I).

Purpose of experimental designs and their basic assumptions; individual comparisons, components of error, confounding; applications from various fields. *Prerequisite, Stat 121 or 551 or 531.*

562. ADVANCED STATISTICAL ANALYSIS OF EXPERIMENTAL DATA (II).

Analysis of data with disproportionate subclass numbers. Includes the method of fitting constants, the method of weighted squares of means, absorption of equations, expectations of mean squares, and tests of hypotheses. *Prerequisite, Stat 561.*

571. SURVEY SAMPLING.

The theory and practice of sampling, optimum allocation of resources, estimation of sample size, various sampling methods, ratio and regression estimates, the problem of non-response. *Prerequisite, Stat 532, 551, or 615.*

572. SAMPLING THEORY AND METHODS.

Problems and methods of sampling, production and quality control, acceptance sampling, O.C. and A.S.N. curves, types and properties of estimators.
Prerequisite, Stat 532, 551, or 615.

581. MULTIVARIATE ANALYSIS (METHODS).

Application of the theory in Statistics 582 to actual problems; may involve research studies by the students, critiques of published research, or analysis of other bodies of data.

Prerequisite, Stat 532, 551, or 615.

582. MULTIVARIATE ANALYSIS (THEORY).

Correlations and regression, principal components, canonical analysis, analysis of dispersion and covariance, tests of homogeneity, discriminant functions.
Prerequisite, Stat 707.

615. INTRODUCTION TO THE THEORY OF STATISTICS (II).

Distributions of random variables, conditional probability and stochastic independence, moment generating functions, sampling distributions of common statistical estimators, transformation of random variables.
Prerequisite, Math 117 or 124.

616. INTRODUCTION TO THE THEORY OF STATISTICS (II).

Interval estimation, point estimation, sufficient statistics, tests of hypothesis, the analysis of variance, the multivariate normal distribution, distributions of quadratic forms and linear statistical models.
Prerequisite, Stat 615.

NOT FOR GRADUATE CREDIT IN MATHEMATICS AND STATISTICS

(These courses cannot be credited toward an advanced degree in mathematics and statistics.)

Mathematics Courses

500. FUNDAMENTAL CONCEPTS OF MATHEMATICS.

Non-axiomatic propositional calculus (with truth tables), basic quantification theory and set algebra. Binary relations, equivalence relations, partitions, functions. Development of the basic algebraic and topological features of the real numbers from the axioms for a complete ordered field. Complex numbers regarded as ordered pairs of real numbers.

Prerequisite, permission of instructor or adviser.

511. INTRODUCTION TO MODERN ALGEBRA I.

Introduction to groups, rings, and fields.

Prerequisite, Math 167.

512. INTRODUCTION TO MODERN ALGEBRA II.

Continuation of Math 511. Algebraic field extensions and solutions by radicals, canonical forms of matrices, quadratic forms, theory of groups, or other topics in algebra.

Prerequisite, Math 511.

525. ADVANCED CALCULUS I.

Elementary topology of the line and Euclidean n -space, continuous functions, Riemann integration, infinite series and power series.

Prerequisite, Math 165, 166; Math 167 recommended.

526. ADVANCED CALCULUS II.

Continuation of Math 525. Multivariate analysis and the theorems of Green, Gauss, and Stokes.

Prerequisites, Math 167 and Math 525.

557. LINEAR PROGRAMMING AND THEORY OF GAMES.

The Simplex Method and extensions; duality theorems; transportation problems and other applications; finite two-person zero-sum games and the fundamental theorem.
Prerequisite, Math 167.

561. AFFINE AND PROJECTIVE GEOMETRY I.

Coordination of the Desarguesian affine plane; the projective plane as an extension of the affine plane.

Prerequisite, Math 167 or permission of instructor.

562. AFFINE AND PROJECTIVE GEOMETRY II.

Continuation of Math 561. Topics from affine, projective, Euclidean, and non-Euclidean geometry.

Prerequisite, Math 561.

565. TOPOLOGY I.

Introduction to the topology of metric spaces and topological spaces: metrics, topologies, continuity, connectedness, compactness.

Prerequisite, Math 525 or Math 625 or permission of instructor.

566. TOPOLOGY II.

Introduction to the geometric ideas behind algebraic topology. Polyhedra, manifolds, Jordan curve theorem, homology mod 2, classification of surfaces, Brouwer fixed-point theorem.

Prerequisites, Math 511 or 611, and Math 565.

575. TOPICS IN HISTORY OF MATHEMATICS.

Detailed examination of the work of a single great mathematician, the mathematics of a single historical period, or the historical development of a single mathematical idea.

Prerequisite, Math 165, 166.

Statistics Courses

531. INTRODUCTION TO FUNDAMENTALS OF STATISTICAL INFERENCE I.

Random experiments and probability models; independence; conditional probability; sampling, random variables; data representations; special distributions; deduction and inference.

Prerequisite, Math 011 or equivalent.

532. INTRODUCTION TO FUNDAMENTALS OF STATISTICAL INFERENCE II.

Point, interval, and model estimation; hypothesis testing; optimality concepts; power; least squares techniques; decision theoretic notions.

Prerequisite, Stat 531.

551. ELEMENTARY LEAST SQUARES.

REGRESSION, AND ANALYSIS OF VARIANCE

Analysis of variance, the design of experiments, sample surveys, multiple regression, non-parametric tests.

Prerequisite, Stat 121.

Mechanical and Aerospace Engineering

GRADUATE FACULTY

EDWARD SUNDERLAND, *Head of Department of Mechanical and Aerospace Engineering and Professor*, B.S.M.E., Massachusetts Institute of Technology, 1954; M.S.M.E., Purdue, 1956; Ph.D., 1958.

LAWRENCE L. AMBS, *Assistant Professor*, B.S., University of Minnesota, 1960; M.S., 1962; Ph.D., 1967.

MAURICE E. BATES, *Professor*, B.S.E., Michigan, 1934; M.S., Massachusetts Institute of Technology, 1935; Ph.D., 1937.

GEOFFREY BOOTHROYD, *Professor*, B.S.E., University of London, 1957; Ph.D., 1962.

DUANE E. CROMACK, *Associate Professor*, B.S., Massachusetts, 1959; M.E., Yale, 1961; Eng.D., Rensselaer Polytechnic Institute, 1968.

F. ERSKINE CROSSLEY, *Professor*, B.A., Cambridge University, 1937; M.A., 1941; Eng.D., Yale University, 1949.

ROBERT W. DAY, *Professor*, B.S., Massachusetts, 1948; M.M.E., Rensselaer Polytechnic Institute, 1954.

JOHN H. DITTFACH, *Professor*, B.S.M.E., Minnesota, 1947; M.S.M.E., 1948.

JOHN R. DIXON, *Professor*, B.S., Massachusetts Institute of Technology, 1952; M.S., 1953; Ph.D., Carnegie Institute of Technology, 1961.

WILLIAM P. GOSS, *Associate Professor*, B.S., University of Connecticut, 1961; M.S., 1962; Ph.D., 1967.

G. HORVAY, *Professor*, B.S., New York University, 1930; E.E., Columbia, 1931; Ph.D., 1939.

KARL JAKUS, *Assistant Professor*, B.M.E., University of Wisconsin, 1963; M.S., University of California, Berkeley, 1965; Ph.D., University of California, Berkeley, 1968.

ROBERT H. KIRCHHOFF, *Assistant Professor*, B.M.E., University of Santa Clara, 1961; M.S., University of Arizona, 1963; Ph.D., University of California, Berkeley, 1969.

JON G. MCGOWAN, *Associate Professor*, B.S., Carnegie Institute of Technology, 1961; M.S., Stanford, 1962; Ph.D., Carnegie Institute of Technology, 1965.

LAWRENCE MURCH, *Assistant Professor*, B.S., Northeastern, 1965; M.S., Clarkson College of Technology, 1968; Ph.D., University of Massachusetts, 1972.

CARL W. NELSON, *Associate Professor of Metallurgy*, B.S., Case Institute of Technology, 1956; M.S., 1963; Ph.D., 1965.

JOSEPH M. O'BYRNE, *Associate Professor*, B.S.M.E., Cincinnati, 1950; M.E., 1952; M.S.M.E., Kentucky, 1952.

ROBERT K. PATTERSON, *Associate Professor*, B.S., Maine, 1948; M.S., 1955.

KENNETH G. PICHA, *Professor and Dean of the School of Engineering*, B.S., Georgia Institute of Technology, 1946; M.S., 1948; Ph.D., Minnesota, 1957.

CORRADO R. POLI, *Professor*, B.S., Rensselaer Polytechnic Institute, 1957; M.S., 1958; Ph.D., Ohio State, 1965.

JOHN E. RITTER, *Associate Professor of Materials Engineering*, B.S., Massachusetts Institute of Technology, 1961; M.S., 1962; Ph.D., Cornell, 1966.

G. ALBERT RUSSELL, *Associate Professor*, B.S., Massachusetts Institute of Technology, 1958; M.S., Arizona State, 1961; Ph.D., Connecticut, 1967.

PAUL E. TARTAGLIA, *Assistant Professor*, B.M.E., University of Detroit, 1967; M.S., Northwestern University, 1968; Eng.D., University of Detroit, 1970.

WILLIAM R. D. WILSON, *Associate Professor*, B.S., Queens University of Belfast, 1963; Ph.D., 1967.

JOHN W. ZAHRADNIK, *Professor*, B.S., Pennsylvania State University, 1950; M.S., Iowa State University, 1951; Ph.D., Massachusetts Institute of Technology, 1965.

GEORGE E. ZINSMEISTER, *Associate Professor*, B.M.E., Rensselaer Polytechnic Institute, 1961; M.S., Purdue, 1963; Ph.D., 1965.

The Master of Science program in Mechanical Engineering is designed to meet the needs of students planning either doctoral study or professional employment. Thirty credit hours are required, 6 of which are to be earned by taking one course from any two of the following groups:

Group A: MAE 702. Thermodynamics.

MAE 722. Advanced Fluid Mechanics.

Group B: MAE 730. Advanced Solid Mechanics.

MAE 740. Advanced Dynamics.

Group C: MAE 608. Physical Metallurgical Principles.

Six credits of Mathematics are required, and a thesis or project of from 6 to 9 credits is normally required. The remaining credits are electives for specialization in such areas as heat transfer, fluid mechanics, thermodynamics, dynamics and vibrations, machine or system design, propulsion, aerodynamics, biological processing, and metallurgy or materials processing.

The Doctor of Philosophy program in Mechanical Engineering imposes no minimum credit hours but each course program must include the following elements:

a. Advanced and comprehensive study in the fundamentals of mechanical engineering including appropriate science courses in mathematics, physics, and chemistry;

b. Intensive study of a special discipline within mechanical engineering (for example, heat transfer, mechanics, gas or fluid dynamics, design, etc.), including study of the current literature;

c. Either intensive study of a second special discipline within mechanical engineering, including study of the current literature, or study in another discipline. The selection of this second discipline and the program of study is subject to approval by the student's Guidance Committee and by the Mechanical Engineering Graduate Committee but it is the intent of the option to allow and even encourage wide latitude in the selection of fields from engineering, science, social science, arts, or humanities.

ALL COURSES CARRY 3 CREDITS UNLESS OTHERWISE SPECIFIED

COURSES OPEN TO GRADUATE STUDENTS ONLY

(For either major or minor credit)

700. SPECIAL PROBLEMS IN MECHANICAL AND AEROSPACE ENGINEERING.

Special investigation or research problems, the scope to be varied to meet specific conditions.

Prerequisite, as required by the problem. Credit, 1-6.

701. ADVANCED THERMODYNAMICS.

Theory of advanced, direct and indirect, energy conversion systems. Thermodynamic cycle optimization methods. Irreversible thermodynamics as applied to steady state energy conversion systems. Direct energy conver-

sion systems include MHD, fuel cells, thermoelectric, thermionic, and other current systems.
Prerequisite, MAE 702 or equivalent. Mr. McGowan.

702. THERMODYNAMICS.

Review of classical thermodynamics and conventional energy conversion systems. Introduction to kinetic theory of gases, and statistical thermodynamics. Selected topics in chemical thermodynamics.
Prerequisite, graduate standing or permission of instructor. Mr. Ambs, Mr. McGowan.

705. ADVANCED HEAT TRANSFER I – CONDUCTION.

Development of the general heat conduction equation for nonhomogeneous and anisotropic materials with temperature dependent properties. Formulation of boundary conditions in heat conduction problems. Solution of sample resulting boundary value problems using separation of variables, integral transform and finite difference techniques.
Prerequisite, MAE 582 or equivalent. Mr. Zinsmeister.

706. ADVANCED HEAT TRANSFER II – CONVECTION.

Development of the general energy equation for convective heat transfer from basic concepts of energy and mass flow. Application to laminar and turbulent, internal and external convective heat transfer problems. Solution methods, including boundary layer theory, similarity concepts, integral approximation methods, and numerical techniques. Introduction to mass transfer.
Prerequisite, MAE 772, or equivalent.

Mr. Jakus, Mr. Goss.

707. VISCOUS FLUIDS.

Exact solutions to the Navier-Stokes equations, slow flow, and boundary layer flow. One-dimensional gas dynamics, shock waves, the acoustic equations, and application of the theory of characteristics to compressible flow.
Prerequisite, MAE 722 or equivalent. Mr. Jakus.

709. MECHANICAL PROPERTIES OF MATERIALS.

Dislocation theory and its application to the mechanical properties of non-organic materials.
Prerequisite, MAE 608 or equivalent.

Mr. Nelson, Mr. Ritter.

713. ADVANCED PROPULSION SYSTEMS.

Design, control, and integration of propulsion systems with the vehicle. Air-breathing engines, chemical rocket motors, electrical and nuclear engines. Power and energy limited systems for various mission requirements.
Prerequisite, MAE 577 or equivalent. Mr. Ambs.

722. ADVANCED FLUID MECHANICS.

Fundamentals of fluid mechanics including kinematics, the stress tensor, and the basic equations from the conservation of mass, momentum, and energy. The dynamics of an inviscid fluid and vortex motion. MAE 722 and 707 form a one-year comprehensive course in fluid mechanics.
Prerequisite, MAE 265 or equivalent.

Mr. Jakus, Mr. Kirchhoff.

730. ADVANCED SOLID MECHANICS.

A unified treatment of the analysis of solids. Consideration of continuity, mechanical energy, stress and strain. Application to elasticity, thermoelasticity, and plasticity.
Prerequisite, graduate standing or permission of instructor. Mr. Horvay.

740. ADVANCED DYNAMICS.

Advanced dynamics of particles, systems of particles, variable mass systems, and rigid bodies. Gyroscopic motion. Rotating and accelerating frames of reference. Use of energy methods, LaGrange's equations. Hamilton's principle, and Eulerian angles in engineering problems.
Prerequisite, graduate standing or permission of instructor. Mr. Horvay, Mr. Poli.

741. VIBRATIONS II.

Vibration of discrete systems with many degrees of freedom, normal modes and frequencies, approximate methods. Introduction to nonlinear vibrations. Nonlinearities in inertia, damping, restoring forces, etc. Singular points and stability, including approximate methods of solution. Liapunov's method.
Prerequisite, MAE 740.

Mr. Horvay, Mr. Poli.

743. STABILITY OF STRUCTURES.

Correlations of various linear and nonlinear theories with experiments. Creep buckling. Thermal buckling. Buckling due to dynamic loads. Buckling of non-conservative systems.
Prerequisite, graduate standing.

Mr. Horvay.

744. THERMAL EFFECTS IN STRUCTURES.

Uncoupled thermoelastic theory, thermal stresses in beams, rings, plates, and shells. Thermally induced vibrations of beams, plates, and shells. Inelastic thermal stress problems. Stresses in the presence of creep. Ablation phenomena.
Prerequisite, graduate standing.

Mr. Horvay.

746. ADVANCED VIBRATIONS.

Free and forced vibrations of strings, rods, bars, and thin elastic plates. Free vibrations of circular, cylindrical, and conical shells. Forced harmonic vibrations of thin shells. Propagation of elastic waves. Rayleigh surface waves. Statistical concepts of random vibration analysis.
Prerequisite, MAE 740.

Mr. Horvay, Mr. Poli.

750. MECHANISMS AND THEORY OF MACHINES I.

Structure and type synthesis of mechanisms; a solution to the designer's problem of selecting the type of mechanism for a job; applications of the theory of graphs. Digital computer methods for design of linkages; optimization of nonlinear systems. Geometry of plane curves, and instantaneous kinematics of a plane moving body. (Open to qualified undergraduates with permission of instructor.)
Mr. Crossley.

751. MECHANISMS AND THEORY OF MACHINES II.

Dynamics of cam drives; design by computer or simulation by analog computer. Gear train design; problems of efficiency and circulation power in loops. Analog computer simulation of two- and three-dimensional mechanisms in motion. Some three-dimensional linkages and design methods.
Mr. Crossley.

760. ADVANCED MECHANICAL ENGINEERING DESIGN I.

Application of modern advanced methods of design, including inventiveness, evaluation, and decision making, to the synthesis of thermal, fluid, mechanical, electromechanical, and combined systems. Consideration of optimization, reliability, and methods of simulation.
Prerequisite, graduate standing.

Credit, 4. Mr. Tartaglia.

761. ADVANCED MECHANICAL ENGINEERING DESIGN II.

770. ADVANCED COMBUSTION.

Topics in chemically reacting flow systems, heat, mass, and momentum transfer in chemically reacting ducted flows. Topics include chemical equilibrium, chemical kinetics, transport properties, laminar and turbulent flows, droplets and sprays.
Prerequisite, graduate standing and permission of instructor.

Mr. Ambs.

780. ADVANCED MATERIALS PROCESSING.

Advanced treatment of cutting and forming processes for materials. Automation and digital control.
Prerequisite, MAE 520.

Mr. Boothroyd, Mr. Wilson.

790. ENGINEERING PROJECT.

A research, design, or development project. Written preparation and oral defense of a project proposal giving objectives, literature survey, and proposed plan. Written preparation and oral defense of a final report giving results and conclusions. May be repeated for credit. Prerequisite, graduate standing. *Credit, 1-10.*

799. LITERATURE SURVEY AND SEMINAR.

A comprehensive study and organization of the current literature on a selected topic. Presentation of the survey in an open seminar including Department faculty and graduate students. Open only to students who have passed Preliminary Examinations. *Not for credit.*

Selected Topics Courses

To best serve the varied interests of its graduate students, the Department has available the following set of selected topics courses. These are one-semester courses and not individualized reading courses. The particular choice of subject matter to be covered in any one of these courses depends upon the specialized needs and interests of the students and is tailored to their requests. The courses are offered only on sufficient demand.

801. SELECTED TOPICS IN THERMODYNAMICS. Current topics in thermodynamics. An in-depth investigation of a specific topic or specialized thermodynamic system. Emphasis on concurrent reading of the literature. Prerequisite, MAE 701. Mr. Ambs, Mr. McGowan.

811. SELECTED TOPICS IN HEAT TRANSFER. Topics may be chosen from the following: nonlinear problems in heat conduction with emphasis on temperature-dependent properties; heat conduction in composite and anisotropic materials; heat transfer with change of phase (boiling, condensation, sublimation, melting, and freezing); finite difference and integral approximation techniques in heat transfer; introduction to radiation heat transfer including combined radiation-conduction and radiation-convection. Prerequisites, MAE 705 and/or MAE 706. Mr. Goss, Mr. Zinsmeister.

821. SELECTED TOPICS IN FLUID MECHANICS. Any one or two of the following topics: numerical methods in fluid mechanics; advanced measurement techniques: advanced compressible flow; singular perturbation theory; magnetohydrodynamics; free molecule flow-kinetic theory. Prerequisite, MAE 707. Mr. Kirchhoff.

831. SELECTED TOPICS IN SOLID MECHANICS. Topics normally chosen from such areas as stability of structures, thermal effects in structures, inelastic behavior of materials, and shell theory. Prerequisite, MAE 730. Mr. Horvay, Mr. Poli.

841. SELECTED TOPICS IN VIBRATIONS. A more in-depth study of some of the topics covered in 741 and 746; usually topics in the area of nonlinear vibrations, stability theory, or random vibrations. Prerequisites, MAE 741 and/or MAE 746. Mr. Horvay, Mr. Poli.

851. SELECTED TOPICS ON MECHANISMS AND MACHINE DESIGN.

A few of the following may be studied as a continuation of MAE 751: Classical Burmester theory. The geometry of screw systems, line complexes, and their relation to the mobility of linkages. Use of dual numbers, quaternions, and dual matrices in the computer solution of spatial mechanism design problems. Application of Chebyshev approximation methods in design. Dynamic analysis and balancing of linkages. Dynamics of mechanical systems with play, backlash, or separation of the parts as in cams, with either analog or computer simulation. Dynamics of mechanisms containing springs of highly elastic elements;

nonlinear vibratory systems; stability according to Mathieu-Hill; systems with different regimes of behavior. Prerequisite, MAE 751. Mr. Crossley.

871. SPECIAL TOPICS IN COMBUSTION AND PROPULSION.

Special topics according to student and instructor interest selected from the current literature. An in-depth student investigation of some aspect of the problem. Prerequisites, MAE 713 and/or MAE 770. Mr. Ambs.

881. SELECTED TOPICS IN MATERIALS.

Advanced study in topics of current interest. Examples include thermodynamics of phase transfer motions, mechanical behavior of ceramic materials, composite materials, and relaxation phenomena in metals. Prerequisite, MAE 709. Mr. Nelson, Mr. Ritter.

800. MASTER'S THESIS.

Credit, 3-10.

900. DOCTORAL DISSERTATION.

Credit, 15.

COURSES OPEN TO BOTH GRADUATE AND UNDERGRADUATE STUDENTS

(For either major or minor credit)

520. MATERIALS PROCESSING.

Analysis of the metal-cutting process including: mechanics of metal cutting; temperature generated; tool life and tool wear; cutting fluids and surface roughness; economics. The grinding process and electrical machining process. Analysis of metal-forming processes including wire drawing, extrusion, deep drawing rolling, blanking. Mr. Boothroyd.

548. STRUCTURES FOR MECHANICAL AND AEROSPACE ENGINEERS I.

Introduction to the load and temperature environment of structures. Review of stress and strain with an introduction to the theory of elasticity. Theories of blending, extension, torsion and shear of slender beams without structural discontinuities. Introduction to work-energy principles and their application to the deflection and stress analysis of complex structures. Examples from the fields of mechanical and aerospace engineering. Prerequisite, MAE 145. Mr. Poli.

549. STRUCTURES FOR MECHANICAL AND AEROSPACE ENGINEERS II.

Continuation of MAE 548. Elastic instability. Applications to axially symmetrical problems, curved beams and stress concentrations. Applications to plates and shells. Introduction to problems involving viscous and plastic behavior. Numerical methods. Prerequisites, MAE 548 or permission of instructor. Mr. Poli.

554. PRODUCT DESIGN I.

Human values in design. Central philosophy of product design. Emphasis on the relation between technical and human values, creativity, and design methodology. Laboratory includes the development of simple product concepts visualized in rapidly developed three-dimensional mockups. Two class hours, two 2-hour laboratory periods. Mr. Umholtz.

555. AQUACULTURAL ENGINEERING SYSTEMS (OE 591).

Rate theory and similitude in the scaling of biological processes. Case study of biological data used in the derivation of useful engineering system design relationships for the culture of mollusks. A bioengineering comparison of several systems used in aquaculture. Mr. Zahradnik.

557. PRODUCT DESIGN II.

Continuation of MAE 554. Integration of knowledge, methodology, and skills obtained in previous work applied and extended to product design. Semester-long

design project with formal presentation to professional jury.

Prerequisite, MAE 554.

Two class hours, two 2-hour laboratory periods.

Mr. Umholtz.

574. PERFORMANCE OF FLIGHT VEHICLES.

Aircraft performance, static and maneuvering. Fundamental astronautics, two-body, problem transfer orbits, rendezvous, intercept, lunar and interplanetary trajectories.

Prerequisites, MAE 246, 265. Mr. Cromack, Mr. Poli.

576. COMBUSTION.

Phenomenological study of combustion processes in flowing systems.

Prerequisite, MAE 264.

Mr. Ambs.

577. INTERNAL COMBUSTION ENGINES.

The thermodynamic and performance aspects of reciprocating gasoline and Diesel engines, steady flow gas turbines and turbo-jet engines, and rockets are major topics.

Prerequisite, MAE 264. Mr. Ambs, Mr. Dittfach.

578. AEROSPACE PROPULSION.

Primary and auxiliary power sources. Matching of air-breathing and rocket motors with vehicle. Electrical and nuclear propulsion systems.

Prerequisite, MAE 287.

Mr. Ambs.

582. HEAT TRANSFER.

Methods of evaluating heat transfer rates and predicting operating temperatures. Heat transfer by conduction, radiation, and convection. Topics include one- and two-dimensional conduction, heat flow, transient heat fins, numerical and graphical solutions, free and forced convection and radiation.

Prerequisites, MAE 264 and Math 186 or 541.

Mr. O'Byrne and Mr. Zinsmeister.

583. MACHINE DESIGN.

Principles of the design of various machine parts; economy of manufacture, safety, styling, invention and creativity.

Two class hours, one 3-hour laboratory period.

Prerequisites, MAE 293, 235, and 237.

Mr. Bates, Mr. Crossley.

585. VIBRATIONS I.

Elements of vibration theory, vibration isolation, absorbers, instrumentation, analysis of equivalent masses and shaft systems. Dynamic balancing.

Prerequisite, MAE 246.

Mr. Crossley, Mr. Poli.

586. ADVANCED MACHINE DESIGN.

Continuation of MAE 563. Additional elementary parts are analyzed, and some complete machines are studied. Considerable emphasis on invention and creativity.

Two class hours, one 3-hour laboratory period.

Prerequisite, MAE 583.

Mr. Bates, Mr. Crossley.

587. GAS DYNAMICS.

Continuation of MAE 265. Continuous and discrete media. Compressible flow equations and compressibility effects. Flow in variable area ducts, normal and oblique shocks. Two dimensional flow. Applications.

Prerequisites, MAE 265 and MAE 263.

Mr. Day, Mr. Kirchhoff.

591. MECHANICAL AND AERO-SPACE

ENGINEERING ANALYSIS II.

Continuation of MAE 284 with emphasis on more complex problems and more advanced mathematical methods.

Two class hours, one 3-hour laboratory period.

Prerequisite, MAE 284.

Mr. Zinsmeister.

594. MECHANICAL AND AERO-SPACE

SYSTEMS ANALYSIS.

Application of engineering analysis techniques to large-

scale systems. Concepts and methodology of systems engineering.

Prerequisite, EE 142 or permission of instructor.

Mr. Russell.

595. MECHANICAL AND AERO-SPACE

ENGINEERING DESIGN.

Application of fundamentals of technology to complex design projects.

One class hour, two 3-hour laboratory periods.

Mr. Dixon, Mr. Tartaglia.

608. PHYSICAL METALLURGICAL PRINCIPLES. Principles underlying the structure and behavior of metals. Equilibrium and non-equilibrium phase relations in one- and two-component systems. Kinetics of diffusion and nucleation. Phase transformations, heat treatment, and hardenability.

Prerequisite, graduate standing or permission of instructor.

Mr. Nelson, Mr. Ritter.

615. AERODYNAMICS.

Application of theoretical fluid mechanics to aerodynamics including topics of theory of lift; finite wing theory; the effects of compressibility and viscosity on lift and drag; slender body theory.

Prerequisite, MAE 265 or equivalent.

Mr. Cromack.

616. STABILITY AND CONTROL OF VEHICLES.

Introduction to the general concepts of stability of motion. The stability of air, space, and ground vehicles.

Prerequisite, MAE 574 or permission of instructor.

Mr. Cromack, Mr. Poli.

650. X-RAY DIFFRACTION.

Principles of crystallography. X-ray diffraction.

Prerequisite, MAE 608.

Mr. Nelson, Mr. Ritter.

Microbiology

GRADUATE FACULTY

CHARLES D. COX, *Head of the Department of Microbiology and Professor*, B.S., Illinois, 1940; M.S., 1941; Ph.D., 1947.

ERCOLE CANALE-PAROLA, *Associate Professor*, B.S., Illinois, 1956; M.S., 1957; Ph.D., 1961.

CLIFTON E. DOWELL, JR., *Associate Professor*, B.A., Texas Christian University, 1955; M.A., 1957; Ph.D., University of Texas, 1962.

STANLEY C. HOLT, *Associate Professor*, B.S., New York University, 1958; M.S., Michigan State, 1960; Ph.D., California at Davis, 1964.

THOMAS G. LESSIE, *Assistant Professor*, B.S., Queens College, 1958; M.A., Harvard, 1961; Ph.D., 1963.

ROBERT P. MORTLOCK, *Associate Professor*, B.S., Rensselaer Polytechnic Institute, 1953; Ph.D., Illinois, 1958.

LEONARD C. NORKIN, *Assistant Professor*, B.S., Rensselaer Polytechnic Institute, 1964; Ph.D., Columbia University, 1969.

ALBEY M. REINER, *Assistant Professor*, B.S., Princeton, 1962; M.S., Wisconsin, 1964; Ph.D., Harvard, 1968.

CURTIS B. THORNE, *Professor*, B.S., West Virginia Wesleyan, 1943; M.S., Wisconsin, 1944; Ph.D., 1948.

MARTIN S. WILDER, *Assistant Professor*, B.S., Brooklyn College, 1960; M.S., University of Kansas, 1963; Ph.D., 1966.

The Department of Microbiology provides facilities for students intending to complete the requirements

for the Master of Science and Doctor of Philosophy degrees. Students accepted for graduate study are expected to have met the usual requirements for the bachelor's degree. Those students considered by the Department to be deficient in cognate sciences may be accepted as graduate student majors in microbiology and have their deficiencies removed during graduate study. Extensive advanced undergraduate courses in microbiology are not as essential as undergraduate background in chemistry, biological sciences, mathematics and physics, in preparation for graduate work in microbiology. Satisfactory knowledge of microbiology and cognate sciences is required for admission to advanced courses in microbiology. The department requires no foreign-language reading competency for the doctorate.

ALL COURSES CARRY 3 CREDITS UNLESS OTHERWISE SPECIFIED

COURSES OPEN TO GRADUATE STUDENTS ONLY

(For either major or minor credit)

700. RESEARCH.

Not for thesis credit, but normally for research preliminary to registration for thesis credit. May be repeated for a total of no more than 9 credits for a master's degree or 18 credits for a doctor's degree. Permission of instructor required. *Credit, 2-6 each semester.*

710. ADVANCED IMMUNOLOGY.

Advanced theories and laboratory procedures basic to immunology and serology. Permission of instructor required. *Credit, 3-6. Mr. Cox.*

720. ANIMAL VIROLOGY.

The molecular biology of animal viruses and viral genetic systems. Special consideration of poliovirus, influenza, and the DNA and RNA tumor viruses. Permission of instructor required. *Mr. Norkin.*

730. MICROBIAL FERMENTATIONS.

Theories, methods, and processes by which various chemicals and biological materials are produced industrially through the action of microorganisms. Laboratory experiments consider the microorganisms involved, procedures used, and the chemistry of the fermentation reactions. Permission of instructor required.

740. ADVANCED MICROBIAL PHYSIOLOGY.

Primarily laboratory. Growth of bacteria in batch and continuous culture; macro-molecular composition of bacteria grown under different conditions; bacterial respiration and electron transport systems; fractionation and characterization of bacterial enzymes. Emphasis on regulation of their formation and activity. Permission of instructor required.

Credit, 2-5. Mr. Lessie, Mr. Mortlock.

750. MICROBIAL CYTOLOGY.

Lectures, literature reviews, and laboratory; a comprehensive survey of the structure of microbial cells and the functions of their components. Permission of instructor required. *Credit, 3-5. Mr. Holt.*

760. MICROBIAL METABOLISM.

Metabolic pathways and mechanisms in microorganisms. Lectures, readings and discussions. Permission of instructor required. *Mr. Mortlock.*

770. MICROBIAL GENETICS.

Inheritance and variation in microorganisms. Mechanisms of recombination, transformation, transduction, and

other genetic phenomena in microorganisms. Emphasis on molecular basis. Permission of instructor required.

Credit, 4. Mr. Thorne.

780. HOST-PARASITE RELATIONSHIPS.

Intensive treatment of specific relationships between parasitic microorganisms and their hosts, by appropriate literature and laboratory studies. Permission of instructor required.

Credit, 2-5. Mr. Wilder.

790. SEMINAR.

Reports and discussions of pertinent literature and research. Normally required of all graduate majors each semester in residence. Permission of instructor required.

Credit, 1.

800. MASTER'S THESIS.

Credit, 10.

890. CURRENT TOPICS.

Intensive consideration of a specific microbiological topic of current interest utilizing staff and student participation and visiting scientists. Lectures and discussions only. Credit depends upon particular topic. Permission of instructor required.

Credit, 1-2.

900. DOCTORAL DISSERTATION.

Credit, 30.

COURSES OPEN TO BOTH GRADUATE AND UNDERGRADUATE STUDENTS

(For either major or minor credit)

550. GENERAL MICROBIOLOGY.

General consideration of microbial structure, growth and physiology, and the reactions of microorganisms to their physical, chemical, and biological environments. For students intending to take more advanced courses in microbiology and other science majors.

Two class hours, two 3-hour laboratory periods.

Prerequisites, Chem 262, 166, or 160; and one semester of biological science. *Credit, 4.*

560. MICROBIAL DIVERSITY.

Principles of selective enrichment and isolation; morphological, physiological, and ecological characteristics of a number of microbial groups isolated from nature.

Two class hours, two 3-hour laboratory periods.

Prerequisite, Microbiol 550.

Credit, 4. Mr. Canale-Parola.

580. PATHOGENIC BACTERIOLOGY.

Correlation of physiological and morphological properties of bacteria with virulence and pathogenesis of disease.

Prerequisite, Microbiol 550.

Credit, 4. Mr. Wilder.

610. IMMUNOLOGY.

The nature of antigens and antibodies, their interactions and significance in resistance and hypersensitivity.

Two class hours, two 3-hour laboratory periods.

Prerequisite, Microbiol 550.

Credit, 4. Mr. Cox.

620. VIROLOGY.

The structure, and the chemical, physical, and biological properties of bacterial viruses.

Two class hours, two 3-hour laboratory periods.

Prerequisites, Microbiol 550 and permission of instructor. *Credit, 4. Mr. Dowell.*

640. MICROBIAL PHYSIOLOGY.

Microbial chemistry and growth. Composition of bacterial cells, energy metabolism, biosynthesis of macromolecules and macromolecule precursor materials, and regulatory mechanisms governing these events. Permission of instructor required. *Mr. Mortlock, Mr. Lessie.*

Music

GRADUATE FACULTY

PHILIP BEZANSON, *Head of the Department and Professor*, B.Mus., Yale School of Music, 1940; M.A., University of Iowa, 1948; Ph.D., 1951.

JOHN R. KING, *Professor and Director of Graduate Studies*, B.Mus., Cambridge University, 1935; M.A., 1939. F.A.G.O. (American Guild of Organists), 1945; Ph.D., University of Toronto, 1950.

NIGEL COXE, *Assistant Professor*, L.R.A.M. (Royal Academy of Music, London), 1950; F.R.A.M., 1964.

RICHARD DuBOIS, *Associate Head of Department and Professor*, B.Mus., Heidelberg College, 1948; M.M., American Conservatory of Music, 1949; Ph.D., University of Iowa, 1964.

ROBERT STERN, *Associate Professor*, B.A., University of Rochester, 1955; M.A., Eastman School of Music, 1956; Ph.D., 1962.

PETER H. TANNER, *Associate Professor*, B.M., Eastman School of Music, 1958; M.M., 1959; Ph.D., The Catholic University of America, 1967.

FREDERICK C. TILLIS, *Associate Professor*, B.A., Wiley College, 1949; M.A., University of Iowa, 1952; Ph.D., 1963.

MIRIAM WHAPLES, *Associate Professor*, B.A., Indiana University, 1950; M.M., 1954; Ph.D., 1958.

A minimum of 33 hours and a comprehensive oral examination are required for the Master of Music degree. A basic core of courses in music theory and history and ensemble work is required of all degree candidates. The further hours are required according to the area of concentration, as advised, and electives are usually possible.

Areas of concentration are: Applied Music; Music Education; Music History; Theory-Composition. Candidates for the M.M. in Composition must submit, in lieu of a research thesis, one original composition in large form (chamber music, orchestral, choral with instruments, or the like).

For admission in any area of concentration an audition in person (or by tape) is required in the applicant's major performance subject (instrument or voice). In Theory-Composition, scores of recent work are additionally required. On registration day Placement Examinations are held in music theory and history and in piano proficiency. Each applicant should write immediately and separately to the Music Department for the M.M. leaflet, and name his performance subject.

ALL COURSES CARRY 3 CREDITS UNLESS OTHERWISE SPECIFIED

COURSES OPEN TO GRADUATE STUDENTS ONLY

700. SPECIAL PROBLEMS. *Credit, 1-6.*

701, 702. SEMINAR IN MUSICOLOGY. Materials and methods of systematic and historical musicology. Specialized topics investigated each semester. The application to different problems of various subjects

such as history, acoustics, aesthetics, analysis. May be repeated for credit with varying content as advised.

Mr. King.

710. COUNTERPOINT (Canon and Fugue). Writing and analysis of invertible counterpoint, various canonic devices, and fugue.

711, 712. COMPOSITION.

Free composition in various forms and media. Individual lessons. Weekly seminar.

Mr. Bezanson.

713-716. ANALYSIS OF MUSIC LITERATURE.

Representative compositions from each period. Analysis by score and sound of the various musical forms and media. Offered on a rotation basis of period courses as follows:

713. ANALYSIS OF MUSIC LITERATURE, 1600-1750.

714. ANALYSIS OF MUSIC LITERATURE, 1750-1825.

715. ANALYSIS OF MUSIC LITERATURE, 1825-1900.

716. ANALYSIS OF MUSIC LITERATURE, 1890-PRESENT.

717. HISTORY AND PEDAGOGY OF THEORY.

Principal authors of treatises dealing with composition, counterpoint, and harmony. Emphasis on the relationship between the works discussed and contemporary pedagogical techniques of presenting theory and allied subjects.

721-738. APPLIED MUSIC-INDIVIDUAL INSTRUCTION.

Literature and instrumental technique or voice production. Audition required.

Credit, 1-4.

721. APPLIED PIANO. Mr. Coxé.

723. APPLIED VOICE.

724. APPLIED VIOLIN. Mr. Olevsky.

725. APPLIED VIOLA. Mr. Olevsky.

726. APPLIED CELLO.

728. APPLIED FLUTE.

729. APPLIED OBOE.

730. APPLIED CLARINET.

731. APPLIED BASSOON.

732. APPLIED SAXOPHONE.

733. APPLIED TRUMPET.

734. APPLIED FRENCH HORN.

735. APPLIED TROMBONE.

736. APPLIED BARITONE HORN.

737. APPLIED TUBA.

738. APPLIED PERCUSSION. Mr. Tanner.

741. SUPERVISION AND ADMINISTRATION OF MUSIC.

The function of the music supervisor, and administrative problems in public school.

Mr. du Bois.

742. RESEARCH IN MUSIC EDUCATION.
Individual research projects in selected areas of Music Education. Mr. du Bois.

751. GENERAL MUSIC IN THE ELEMENTARY SCHOOL.
Study and evaluation of contemporary methods and materials of general music in the elementary school.

752. INSTRUMENTAL MUSIC IN THE PUBLIC SCHOOL.
Organization of the instrumental program from the elementary through the senior high school. Materials and methods of solo, class, and large ensemble instruction.

753. CHORAL MUSIC IN THE PUBLIC SCHOOL.
Organization of the choral program in the junior and senior high school. Materials and methods of teaching small and large vocal ensembles. Mr. du Bois.

754. ADVANCED ORCHESTRAL CONDUCTING.
Score analysis, rehearsal techniques, and advanced conducting problems of orchestral ensembles.

755. ADVANCED CHORAL CONDUCTING.
Score analysis, rehearsal techniques, and advanced conducting problems of choral ensembles. Mr. du Bois.

800. MASTER'S THESIS. *Credit, 3-10.*

COURSES OPEN TO BOTH GRADUATE AND UNDERGRADUATE STUDENTS

014. REMEDIAL THEORY.
For students deficient in undergraduate theory. Materials adapted to individual requirements. *Credit, 0.*

503. MUSIC HISTORY—FROM MONTEVERDI TO BACH.
The Baroque and Rococo periods, including the music of such composers as Monteverdi, Schütz, Lully, Purcell, Corelli, Couperin, Rameau, the Scarlattis, Bach, Handel.

505. MUSIC HISTORY—MEDIEVAL AND RENAISSANCE MUSIC.
Chant and organum through Renaissance motet and madrigal. Reading, listening, score study, analysis. Mrs. Whaples.

509. MUSIC HISTORY—MUSIC OF THE 20TH CENTURY.
Music, European and American, written since 1900. Includes Stravinsky, Bartok, Hindemith, Copland, jazz, and electronic music. Mr. Tillis.

515. COUNTERPOINT.
Techniques of counterpoint, and analysis of polyphonic music of the 16th century. Composition in small forms, utilizing contrapuntal techniques.

516. ORCHESTRATION.
Problems in scoring for various ensembles including full orchestra. Mr. Stern.

517. CONTEMPORARY TECHNIQUES.
Examination of melody, rhythm, harmony, and form in 20th-century music. Analysis, listening, written assignments. *Credit, 2.* Mr. Stern.

525. MARCHING BAND TECHNIQUES.
Organization, training, and repertoire for the high school and college marching band. Charting of drills, formations, and continuity. *Credit, 2.*

526. ADVANCED CHORAL LITERATURE AND TECHNIQUES.
Historical survey of choral literature and the study of performance practices.

527. ADVANCED ORCHESTRAL LITERATURE AND TECHNIQUES.
Historical survey of orchestral literature and the study of performance practices.

528. ADVANCED BAND LITERATURE AND TECHNIQUES.
Historical survey of wind ensemble and band literature and the study of performance practices.

601. MUSIC HISTORY—HAYDN, MOZART, AND BEETHOVEN.
Reading, listening, score study. Besides music of Haydn, Mozart, and Beethoven, that of their contemporaries may also be included. Mrs. Whaples.

602. MUSIC HISTORY—FROM SCHUBERT TO DEBUSSY.
Historical study of 19th-century music in small and large forms, and various media including Lieder, chamber music, symphony, opera. Reading, listening, score study. Mrs. Whaples.

603. MUSIC HISTORY—HISTORY OF OPERA.
History of opera from the late 16th through the present century.

Performing Organizations

761. UNIVERSITY CHORALE.
Advanced choir, selected by audition. Preparation and performance of choral literature ranging from the Renaissance to contemporary music. Performance on campus and on concert tours. Three rehearsals a week. Chamber Singers selected from this group. *Credit, 1.* Mr. du Bois.

762. UNIVERSITY CHORUS.
Open to all. Preparation and concert performance of oratorios and other large choral works. *Credit, 1.*

765. WOMEN'S CHOIR.
A select choir specializing in literature for women's voices. Audition required. *Credit, 1.*

767. CHAMBER SINGERS.
Vocal ensembles specializing in performance of chamber music from Renaissance to contemporary. Audition required. *Credit, 1.* Mr. du Bois.

768. MADRIGAL SINGERS.
Vocal ensemble specializing in music of the Renaissance. Audition required. *Credit, 1.*

771. UNIVERSITY ORCHESTRA.
Preparation and performance of orchestral literature of various styles and periods. *Credit, 1.*

781. MARCHING BAND.
Preparation and performance of pre-game and half-time shows during the football season. May be taken one semester with a semester of Music 782 or 783, or for two semesters. *Credit, 1.*

782. SYMPHONY BAND.
Preparation and performance of band and wind ensemble literature of various styles and periods. May be taken one semester with a semester of Music 781 or 783, or for two semesters. *Credit, 1.*

783. CONCERT BAND.
Preparation and limited performance of selected band literature. May be taken one semester with a semester of Music 781 or 782, or for two semesters. *Credit, 1.*

787. ENSEMBLE.
Preparation and performance of appropriate literature for small instrumental and vocal ensembles. *Credit, 1.*

Nursing

GRADUATE FACULTY

NEL GETCHEL, *Director, Graduate Studies in Nursing and Associate Professor*, R.N., New Hampshire Hospital School of Nursing, 1952; B.S., Wayne State University, 1956; M.S., Boston University, 1966; Ed.D., 1971.

VIRGINIA EARLES, *Professor of Medical-Surgical Nursing*, B.S.N., Syracuse University, 1950; M.S., 1954.

LILLIAN R. GOODMAN, *Acting Dean and Professor*, R.N., Peter Bent Brigham Hospital School of Nursing, 1948; B.S., Boston University, 1950; M.S., 1954; Ed.D., 1969.

SUSAN D. GRANCIO, *Assistant Professor of Medical-Surgical Nursing*, B.S.N., Georgetown University, 1965; R.N., New York University, 1969; M.A., 1969.

ANNE MARIE HAASE, *Associate Professor*, B.S., State University of New York, 1963; M.A., University of Connecticut, 1967; Ph.D., 1969.

MAY B. HALL, *Assistant Professor of Psychiatric-Mental Health Nursing*, R.N., St. Barnabas Hospital for Women and Children, 1939; B.S., Marquette University, 1951; M.S., Boston University, 1953.

MARY E. HELMING, *Professor of Nursing*, R.N., Massachusetts General Hospital School of Nursing, 1940; B.S., Simmons College, 1948; M.S.N., The Catholic University of America, 1954.

CATHERINE A. HINES, *Assistant Professor of Psychiatric Nursing*, B.S.N., University of Connecticut, 1957; R.N., Boston University, 1960; M.S., 1960.

CONSTANCE A. PETRUNENKO, *Associate Professor of Community Nursing*, R.N., Children's Hospital School of Nursing, 1942; B.S.N., Boston University, 1948; M.A., Columbia University, 1952.

HILDEGARD SALENUS, *Associate Professor of Psychiatric-Mental Health Nursing*, R.N., St. Luke's & Children's Medical Center, 1948; B.S., University of Denver, 1956; M.S., University of Colorado, 1958; D.N.Sc., Boston University, 1965.

LORETTA R. SHARP, *Associate Professor of Pediatric Nursing*, B.S.N., University of Colorado, 1944; M.A., University of Chicago, 1954.

RUTH A. SMITH, *Assistant Professor of Community Nursing*, R.N., Massachusetts General Hospital School of Nursing, 1944; B.S., University of Connecticut, 1953; M.N., University of Washington, 1961.

ALVIN E. WINDER, *Professor*, B.A., Brooklyn College, 1947; M.S., University of Illinois, 1948; Ph.D., University of Chicago, 1952.

The program has been developed in consideration of four broad areas: first, the need for clinical specialization to follow the general preparation in baccalaureate education; second, the changing needs of society in regard to nursing which are intimately related to the rapid advances in health practice based upon the explosion of knowledge in the sciences; third, the imperative need for the development of

theoretical content for the profession of nursing based upon research and other scholarly pursuits; and, fourth, the need for the development of leadership personnel who have new knowledge, new insights and concepts, and who are prepared to cope with the constantly changing functions and roles of the professional nurse. Clinical specialization in Community Health Nursing, Medical-Surgical Nursing, and Psychiatric-Mental Health Nursing is provided.

The first three semesters emphasize advanced study in clinical nursing, both theory and practice, and advanced study of the natural and behavioral sciences, and an introduction to research methodology. In the fourth semester, the student may elect to concentrate in one of the functional areas—supervision and administration of nursing, or the teaching of nursing. Concurrent field practice is provided in both areas. As a third alternative, the student may choose to continue clinical study, concentrating in greater depth in some specialized area of the major field or in a second area of clinical interest.

Candidates for admission, in addition to the minimum Graduate School requirements, must present evidence of:

- a. Graduation from a baccalaureate program in nursing accredited by the National League for Nursing.

- b. Evidence of academic ability, on the basis of the Miller Analogy Test or the Graduate Record Examination.

- c. Professional references indicating expectation of success in a graduate program.

Requirements for the master's degree in nursing include:

1. Total of 48 credits, of which a minimum of 36 are in combined clinical nursing and related behavioral and natural sciences and research. The remaining 12 credits may be in one of the functional areas of administration or teaching of nursing or may be devoted to the study of a specialized area in the major clinical field or a second clinical field.

2. Field practice, required of all students who elect a concentration in administration or teaching in the fourth semester.

3. A field study (Nursing 700, Problems) in a selected area of nursing. Must be completed by all students.

ALL COURSES CARRY 3 CREDITS UNLESS OTHERWISE SPECIFIED

COURSES OPEN TO GRADUATE STUDENTS OF NURSING ONLY

700. PROBLEMS IN NURSING.

Independent study, including the completion of a field study of a selected problem in nursing, under guidance of a faculty adviser.

703. MEDICAL-SURGICAL NURSING I.

Theoretical framework for application of the behavioral sciences to enhance the therapeutic process through nurse-patient interaction; understanding of the dynamics of behavior in illness, and in solving clinical problems.

704. MEDICAL-SURGICAL II.

Principles of the biological and physical sciences pertinent to the designation and implementation of highly-skilled patient-care. Includes depth analysis of clinical

data. Emphasis on definition of the scientific basis for nursing action.

705. MEDICAL-SURGICAL NURSING III.

A seminar in clinical nursing devoted to identification of research themes in nursing and medicine, development of theoretical concepts of nursing based on research and clinical study, and identification of research questions relevant to nursing practice. *Credit, 6.*

706. MEDICAL-SURGICAL NURSING IV.

Guided study. Opportunity for development of special skills in nursing, specialization in study of content and pursuit of research interests. *Credit, 6-12.*

708. SEMINAR IN RESEARCH IN NURSING.

Introduction to research design and methods and their application to nursing problems. *Mrs. Haase.*

709. PSYCHIATRIC NURSING I.

Seminar and practicum in clinical and community psychiatric nursing. Opportunities for advanced students to refine and sharpen skills, knowledge, and understanding in defining and performing in the therapeutic role of providing nursing care to individuals who are mentally ill or in preventing such illness.

710. PSYCHIATRIC NURSING II.

Seminar and practicum in defining and determining the therapeutic role of the clinical specialist in providing nursing care needed by groups and families. Primary, secondary, and tertiary prevention emphasized in both theory and practice. Leadership functions identified and experience as the therapeutic role is extended beyond the one-to-one relationship.

711. PSYCHIATRIC NURSING III.

Opportunity for the clinical nurse specialist to become familiar with the consultant role. Practicum experience in functioning as a nursing consultant; theories of communities and consultation necessary for the performance. *Credit, 6.*

712. PSYCHIATRIC NURSING IV.

The culminating experience for the clinical nurse specialist student; opportunity to explore the supervisory and educative facets of the role, and a time for synthesis. Independent work possible in areas of special interest utilizing faculty as resource persons. *Credit, 9-12.*

715. COMMUNITY HEALTH NURSING I.

Seminar and practicum in community health nursing. Focus on the health needs of individuals and families. Theories relevant to family systems examined and applied to the family whom the nurse is caring for in the community. Includes 2 hours for seminar discussion and 4 hours for field work.

751. SEMINAR IN NURSING ADMINISTRATION.

The leadership role of the nursing administrator in the context of various theories of management and organization. Emphasis on the processes of policy formulation and decision-making and the administrator's role as a change agent in determining the character and quality of clinical nursing in an agency. Analysis of administrative problems encountered in concurrent field practice.

761. FIELD PRACTICE IN NURSING ADMINISTRATION.

Under guidance of the faculty adviser and the preceptor in the agency, experiences in various hospital units. Experience and analysis of some of the administrative problems related to provision of direct nursing care. Opportunity to participate in the major activities and to carry selected responsibilities of either the administrator of a clinical department or the director of nursing services, depending upon student background. *Credit, 6*

762. PRACTICUM IN TEACHING.

Experience in teaching in the classroom and clinical setting. Emphasis on experience and critical evaluation of the range of teaching methods cogent to a professional field. *Credit, 3-6.*

Nutrition and Food

GRADUATE FACULTY

PETER L. PELLETT, *Head and Director of Graduate Studies of the Department of Human Nutrition and Associate Professor, B.S., Borough Polytechnic, London, 1952; Ph.D., London School of Hygiene and Tropical Medicine, 1956.*

DONALD L. ANDERSON, *Professor of Animal Science.*

VIRGINIA A. BEAL, *Associate Professor, B.S., Simmons College, 1939; M.P.H., Harvard School of Public Health, 1945.*

MARK H. BERT, *Associate Professor, B.S., Lima University, Peru, 1939; M.S., Illinois, 1948; Ph.D., 1955.*

HEINRICH FENNER, *Assistant Professor of Animal Science.*

SIDNEY L. LYFORD, JR., *Assistant Professor of Animal Science.*

The degree of Master of Science or of Doctor of Philosophy may be earned in the Department by candidates who hold an accredited baccalaureate degree in natural sciences with emphasis on chemistry and biology, or an accredited baccalaureate in home economics with a major in dietetics or nutrition and food. Students must be prepared to remedy undergraduate deficiencies without earning graduate credit.

Candidates for both the Ph.D. and the M.S. degrees must satisfy the requirements established by the University. The program for each candidate for the Ph.D. degree is designed with sufficient flexibility to meet the needs and interests of the student; it includes course work in the major field and in areas related to the major field, a written preliminary comprehensive examination, and a dissertation. The Department requires no foreign language reading competency for the Ph.D. degree. The program for each candidate for the M.S. degree is designed to meet the needs and interests of the student; it includes course work in the major field and in physiology, food science, biochemistry, public health, or food economics, and either a thesis or a written report on a special problem.

ALL COURSES CARRY 3 CREDITS UNLESS OTHERWISE SPECIFIED

COURSES OPEN TO GRADUATE STUDENTS ONLY

(For either major or minor credit)

421. DEVELOPMENTS IN NUTRITIONAL EDUCATION.

Interpretation and application of changing and new concepts of nutrition—its place in schools and health programs.

Prerequisite, three credits in a biological science.

700. SPECIAL PROBLEMS IN NUTRITION OR FOOD.

Prerequisite, permission of department head. *Credit, 3-6.*

703. ADVANCED NUTRITION-CARBOHYDRATES, LIPIDS, AND AMINO ACIDS.

Metabolic role of carbohydrates, lipids, proteins and amino acids; biological oxidations; mechanisms of energy production and utilization.

Prerequisite, Biochem 520 or permission of instructor.

Mr. Pellett, Mr. Bert.

704. ADVANCED NUTRITION-VITAMINS.

Metabolic role of vitamins, specific functions, requirements, sources, assay methods, effects of deficiencies and excesses.

Prerequisite, NF 703 or permission of instructor.

Mr. Bert.

705. ADVANCED NUTRITION-MINERALS.

Metabolic role of minerals, specific functions, requirements, sources, assay methods, effects of deficiencies and excesses.

Prerequisite, NF 703 or permission of instructor.

Mr. Bert, Mr. Fenner.

710. SEMINAR.

Readings, reports, and discussions on the current literature in the area of food or nutrition.

Credit, 1-3; maximum credit, 3.

800. MASTER'S THESIS.

Individual research.

Credit, 6-10.

800. RESEARCH PROJECT.

(Not thesis; for Ph.D. candidates only).

Prerequisite, permission of department head. *Credit, 1-4.*

900. DOCTORAL DISSERTATION

Credit, 15.

COURSES OPEN TO BOTH GRADUATE AND UNDERGRADUATE STUDENTS

(For either major or minor credit)

612. EXPERIMENTAL FOODS.

Fundamental principles of food quality evaluation; development of an independent research problem.

One class hour, two 3-hour laboratories.

Prerequisites, NF 251, Chem 160 or permission of instructor.

640. NUTRITION DURING GROWTH AND DEVELOPMENT.

Nutrition as it affects physical growth and development. Criteria for evaluating nutritional status of children.

Prerequisite, NF 127 or 352.

Miss Beal.

643. HUMAN NUTRITION.

Absorption, utilization, and interrelationship of food nutrients. Factors and critique of methods for determining nutrient requirements.

Prerequisites, NF 127, 251, Biochem 520, Zool 135 or permission of instructor.

Mr. Pellett, Miss Beal.

645. NUTRITION IN DISEASE.

Physiological basis for therapeutic diets in certain diseases. Current medical and nutrition literature used.

Prerequisites, Biochem 520, Zool 135, NF 130, 352, or permission of instructor.

NOTE: The whole graduate program has been revised, and several changes and additional courses will be announced as soon as they are approved by the Faculty Senate.

Philosophy

GRADUATE FACULTY

VERE C. CHAPPELL, *Chairman of the Graduate Faculty of Philosophy, Head of the Department of Phi-*

UNIVERSITY OF MASSACHUSETTS

losophy, and Professor, B.A., Yale University, 1951; M.A., 1953; Ph.D., 1958.

JOHN ROBISON, *Secretary of the Faculty, Associate Head of the Department, and Associate Professor, B.A., University of Georgia, 1957; M.A., Emory University, 1958; Ph.D., University of Pennsylvania, 1962.*

HERBERT HEIDELBERGER, *Director of Studies for the Faculty, Director of Graduate Studies for the Department, and Associate Professor, B.A., New York University, 1955; M.A., Princeton University, 1960; Ph.D., 1962.*

ROBERT ACKERMANN, *Professor, B.A., Capital University, 1954; M.A., Ohio University, 1957; Ph.D., Michigan State University, 1960.*

BRUCE AUNE, *Professor, B.A., University of Minnesota, 1955; M.A., 1957; Ph.D., 1960.*

ANN F. BRENTLINGER, *Assistant Professor, B.A., Swarthmore College, 1959; M.A., Brown University, 1961; Ph.D., 1965.*

JOHN A. BRENTLINGER, *Associate Professor, B.A., University of Chicago, 1958; M.A., Yale University, 1960; Ph.D., 1962.*

RODERICK M. CHISHOLM, *Adjunct Professor (Romeo Elton Professor of Natural Theology and Professor of Philosophy, Brown University), B.A., Brown University, 1938; M.A., Harvard University, 1940; Ph.D., 1942.*

LEONARD H. EHRLICH, *Associate Professor, B.S., Roosevelt University, 1947; M.A., Yale University, 1958; Ph.D., 1960.*

JOSEPH EPSTEIN, *Professor (Amherst College), B.S.S., City College of New York, 1939; Ph.D., Columbia University, 1951.*

FRED FELDMAN, *Assistant Professor, B.A., Bard College, 1963; M.A., Harpur College, 1965; Ph.D., Brown University, 1968.*

LAWRENCE FOSTER, *Associate Professor, B.A., University of Pennsylvania, 1961; Ph.D., 1966.*

MICHAEL GARDNER, *Assistant Professor (Mount Holyoke College), B.A., Reed College, 1966; Ph.D., Harvard University, 1971.*

EDMUND L. GETTIER, III, *Professor, B.A., Johns Hopkins University, 1949; Ph.D., Cornell University, 1961.*

JAMES C. HADEN, *Professor (Hampshire College), B.S., Haverford College, 1943; M.A., Yale University, 1951; Ph.D., 1953.*

MICHAEL JUBIEN, *Assistant Professor, B.A., Dartmouth College, 1965; Ph.D., Rockefeller University, 1972.*

THOMAS R. KEARNS, *Assistant Professor (Amherst College), B.A., University of Illinois, Urbana, 1959; LL.B., University of California, Berkeley, 1962; M.A., 1964; Ph.D., University of Wisconsin, Madison, 1968.*

WILLIAM E. KENNICK, *Chairman of the Department and Professor (Amherst College), B.A., Oberlin College, 1945; Ph.D., Cornell University, 1952.*

MURRAY J. KITELEY, *Chairman of the Department and Professor (Smith College), B.A., University of Minnesota, 1950; M.A., 1958; Ph.D., 1959.*

JOHN J. LETOURNEAU, *Associate Professor of Logic* (Hampshire College), B.S., University of Washington, 1961; Ph.D., University of California, Berkeley, 1968.

WILLIAM MARSH, *Associate Professor of Logic* (Hampshire College), B.A., Dartmouth College, 1963; M.A., 1965; Ph.D., 1966.

GARETH MATTHEWS, *Professor*, B.A., Franklin College, 1951; M.A., Harvard University, 1952; Ph.D., 1961.

FELIX OPPENHEIM, *Professor of Political Science and of Philosophy*, LL.D., Brussels University, 1938; Ph.D., Princeton University, 1942.

KATHRYN PYNE PARSONS, *Associate Professor* (Smith College), B.A., Indiana University, 1961; Ph.D., Stanford University, 1968.

TERENCE PARSONS, *Associate Professor*, B.A., University of Rochester, 1961; Ph.D., Stanford University, 1966.

BARBARA HALL PARTEE, *Associate Professor of Linguistics and of Philosophy*, B.A., Swarthmore College, 1961; Ph.D., Massachusetts Institute of Technology, 1965.

RICHARD S. ROBIN, *Chairman of the Department and Professor* (Mount Holyoke College), B.A., Harvard University, 1948; Ph.D., 1958.

DAVID S. SCHWARZ, *Assistant Professor* (Mount Holyoke College), B.A., Ripon College, 1965; B.Phil., University of St. Andrews, 1968; Ph.D., University of California, Berkeley, 1972.

JEFFREY F. SICHA, *Assistant Professor* (Amherst College), B.A., Oberlin College, 1962; D.Phil., Oxford University, 1966.

MARY SIRRIDGE, *Assistant Professor*, B.A., St. Mary's College, 1967; M.A., Ohio State University, 1971; Ph.D., 1972.

ROBERT C. SLEIGH, JR., *Professor*, B.A., Dartmouth College, 1954; M.A., Brown University, 1957; Ph.D., 1963.

MALCOLM B. E. SMITH, *Assistant Professor* (Smith College), B.A., Virginia Military Institute, 1961; Ph.D., Cornell University, 1969.

GEORGE V. TOVEY, *Associate Professor* (Mount Holyoke College), B.A., Lafayette College, 1942; Ph.D., Columbia University, 1950.

A. THOMAS TYMOCZKO, *Assistant Professor* (Smith College), B.A., Harvard University, 1967; Ph.D., 1972.

CHRISTOPHER WITHERSPOON, *Assistant Professor* (Hampshire College), B.A., Arkansas Polytechnic College, 1965; Ph.D., University of California, Berkeley, 1972.

ROBERT PAUL WOLFF, *Professor*, B.A., Harvard University, 1953; M.A., 1954; Ph.D., 1957.

Two graduate programs are offered in philosophy. The M.A. program is operated by the University's Department of Philosophy, the Ph.D. program by its Graduate Faculty of Philosophy, which includes members of the Amherst, Hampshire, Mount Holyoke, and Smith College Faculties as well as of the University Department.

THE COOPERATIVE Ph.D. PROGRAM

The Ph.D. degree in philosophy is offered by the University of Massachusetts in cooperation with Amherst, Hampshire, Mount Holyoke, and Smith Colleges. Although the degree is awarded by the University's Board of Trustees, a student may be in residence at any one of the five institutions; the institution of residence is noted on his permanent record.

The Cooperative Program in Philosophy is administered by the University's Graduate Faculty of Philosophy. This Faculty consists of all those teachers of philosophy at the five institutions who have been admitted to the Graduate Faculty of the University.

Admission to the Program is determined by the Graduate School of the University upon recommendations made by the Admissions Committee of the Faculty.

Upon entering the Program, each student is assigned a faculty member as his adviser, who then consults with him concerning his schedule of courses, his progress, and any special problems he may encounter.

Students generally take four courses (12 credit hours) each semester during their first two years in the Program. The total course requirement for the Ph.D. degree is 16 courses (48 hours) exclusive of Philosophy 800 and 900. Of these 16, eight (24 hours) must be University philosophy courses numbered above 700. The remaining eight may include: up to six hours of Philosophy 700; University philosophy courses at the 500- or 600-level; comparable courses at the four cooperating Colleges or, with the approval of the Faculty's Director of Studies, at other institutions; or, again with the approval of the Director of Studies, graduate courses in other fields at the University or the cooperating Colleges.

There is no language requirement for the Ph.D. in philosophy.

By the end of his second year of graduate study (four semesters of being registered for one or more courses), each student in the Program must have satisfied the Ph.D. logic requirement by earning a grade of B or better in two of the University Department's four 600-level logic courses, or the equivalent.

By the end of his third year of graduate study, except in special cases to be determined by the Faculty, each student in the Program must have passed all three of the Preliminary Examinations. These examinations are not restricted to the content of the graduate courses which are available at any one time. The three examinations are in history of philosophy, metaphysics and epistemology, and ethics, except that a student may, with the approval of the Faculty, substitute for the examination in ethics an examination in some other field, such as social and political philosophy, aesthetics, philosophy of science, or philosophy of religion.

All three Preliminary Examinations are given once each semester, at times to be determined by the Director of Studies. The three examinations need not be taken in the same semester, and students are particularly encouraged to try them in their first and second years in the Program.

Students in the Cooperative Ph.D. Program may receive the M.A. degree upon satisfying the Ph.D.

logic requirement, passing the three Preliminary Examinations, and completing the Ph.D. course requirement.

Having passed the Preliminary Examinations, each student in the Program acquires a Dissertation Committee, which then oversees the rest of his work for the Ph.D. degree, replacing his adviser. This committee is formally appointed by the Dean of the Graduate School, on the recommendation of the faculty's Director of Studies. The chairman of the Dissertation Committee is the director of the student's dissertation.

When the dissertation is finished, it is submitted to the Dissertation Committee for judgment. If, and only if, the committee approves it unanimously, the dissertation is submitted to the Chairman of the Philosophy Faculty, who, if he also approves it, then schedules the Final Oral Examination.

The Final Oral Examination is conducted by the Dissertation Committee. The examination is open to the University community at large, students and faculty, and any member of the Philosophy faculty may participate in the questioning of the candidate. Only the members of the Dissertation Committee, however, take part in judging his performance; their vote must be unanimous in order for him to pass the examination.

Having passed the Final Oral, the student then has his dissertation finally typed and bound, according to the specifications given in the Graduate School Handbook. The typed original, unbound, and one carbon copy, bound, must be submitted to the Graduate School, and a second copy, bound, to the Faculty of Philosophy, by May 1, September 1, or January 1 for the student to get his degree at the June, October, or February graduations, respectively.

THE MASTER OF ARTS DEGREE PROGRAM

The M.A. Program in Philosophy is administered by the University's Department of Philosophy.

Admission to the program is determined by the Graduate School upon recommendations made by the Department's Admissions Committee.

Upon entering the program, each student is assigned a Department member as his adviser, who then consults with him concerning his schedule of courses, his progress, and any special problems he may encounter.

Students generally take four courses (12 credit hours) each semester during their first year in the Program. The total course requirement for the M.A. degree is 10 courses (30 hours). Of these 10, four (12 hours) must be University philosophy courses numbered above 700, exclusive of Philosophy 800. The remaining six may include: up to six hours of Philosophy 700; six hours of Philosophy 800 (for students choosing Option B below); University philosophy courses at the 500- or 600-level; comparable courses at Amherst, Hampshire, Mount Holyoke, and Smith Colleges; or, with the approval of the Department's Director of Graduate Studies, up to six hours of graduate courses in other fields at the University or the four colleges.

There is no language requirement for the M.A. in philosophy.

During his second semester of graduate study,

each student in the program chooses one of two alternative ways, Options A and B below, of completing the requirements for the M.A. degree.

Option A. Under this option, the student is required to pass two of the three Ph.D. Preliminary Examinations. He then takes an oral examination, conducted by the Department, which is based mainly on, though not necessarily restricted to, his Preliminary Examination answers.

Option B. Under this option, the student writes a master's thesis, under the supervision of a Thesis Committee. This committee is formally appointed by the Dean of the Graduate School, on the recommendation of the Department's Director of Graduate Studies, after the student has completed eight of the ten courses required for the M.A. degree. Six hours of Philosophy 800 may then be used for the remaining two courses. When the thesis is finished and has been approved by the committee unanimously, the student takes a Final Oral Examination, conducted by the committee, whose vote on his performance must be unanimous in order for him to pass. Having passed this examination, the student then has his thesis finally typed and bound, according to the specifications given in the Graduate School Handbook. The dates for submitting the thesis to the Graduate School are the same as those given above for the Ph.D. dissertation.

All requirements for the M.A. degree under both Option A and Option B must be completed within two calendar years of a student's first enrollment in the program.

Not all of the following courses are given every year, nor are they always taught by the same instructors. A list of courses offered in 1973-74, indicating the instructor and the particular topics to be covered in each, will be available in the Philosophy Department office around April 15.

ALL COURSES CARRY 3 CREDITS UNLESS OTHERWISE SPECIFIED

COURSES OPEN TO GRADUATE STUDENTS ONLY

700. RESEARCH AND READING IN PHILOSOPHY. Independent graduate research on specific topics in philosophy under the supervision of a faculty member. Prerequisite, permission of instructor.

Credit, 2-6; maximum credit, 6.

702. SEMINAR: TOPICS IN LOGIC. Mr. Jubien.

705. PROSEMINAR. Mr. Feldman.

710. SELECTED PHILOSOPHER I. Mr. Sleight.

710. SELECTED PHILOSOPHER II.

Mr. Heidelberger.
Mr. Brentlinger.

715. PLATO.

720. KANT: CRITIQUE OF PURE REASON.

Mr. Wolff.
Mr. Ehrlich.

721. KANT: THE LATER WORK.

725. MAJOR WORKS IN EXISTENTIAL PHILOSOPHY.

745. SEMINAR IN ETHICS. Mr. Robison.

750. PHILOSOPHY OF EDUCATION.

751. PHILOSOPHY OF RELIGION.
755. PHILOSOPHY OF LANGUAGE. Mr. Parsons.
756. PHILOSOPHY OF SCIENCE. Mr. Ackermann.
760. METAPHYSICS. Mr. Aune.
761. PHILOSOPHY OF MIND. Mr. Matthews.
765. THEORY OF KNOWLEDGE. Mr. Gettier.
780. PROBLEMS IN THE HISTORY OF PHILOSOPHY I. Ms. Sirridge.
781. PROBLEMS IN THE HISTORY OF PHILOSOPHY II. Mr. Chappell.
790. SEMINAR. Ms. Partee.
791. SEMINAR. Mr. Chisholm.
800. MASTER'S THESIS. Credit, 6.
900. DOCTORAL DISSERTATION. Credit, 30.
- COURSES OPEN TO BOTH GRADUATE AND UNDERGRADUATE STUDENTS
501. PLATO AND ARISTOTLE. Mr. Matthews.
502. PHILOSOPHY IN THE MIDDLE AGES. Ms. Sirridge.
503. EUROPEAN PHILOSOPHY FROM MONTAIGNE TO ROUSSEAU. Mr. Feldman.
504. BRITISH EMPIRICISM. Mr. Foster.
505. KANT AND 19TH-CENTURY PHILOSOPHY. Mr. Wolff.
518. AMERICAN PHILOSOPHY. Ms. Brentlinger.
525. INDIAN PHILOSOPHIES.
526. EAST ASIAN PHILOSOPHIES.
561. CONTEMPORARY ANALYTIC PHILOSOPHY. Mr. Feldman.
564. EXISTENTIAL PHILOSOPHIES. Mr. Ehrlich.
590. POLITICAL PHILOSOPHY. Mr. Oppenheim.
591. MARXISM. Mr. Brentlinger.
630. INTERMEDIATE PHILOSOPHY OF SCIENCE. Mr. Gardner.
641. PHILOSOPHY OF RELIGION. Mr. Robison.
643. AESTHETICS. Ms. Sirridge.
644. EPISTEMOLOGY. Mr. Heidelberger.
645. METAPHYSICS. Mr. Aune.
650. HISTORY OF ETHICS. Ms. Brentlinger.
651. ETHICAL THEORY. Mr. Foster.
665. PHILOSOPHICAL THEOLOGY. Mr. Ehrlich.
670. INTERMEDIATE LOGIC. Prerequisite, 125. Mr. Gettier.
671. PHILOSOPHY AND LOGIC. Prerequisites, 125 and 670. Mr. Sleigh.
672. MATHEMATICAL LOGIC I. Prerequisite, Philos 670 or major in mathematics. Mr. Parsons.
673. MATHEMATICAL LOGIC II. Prerequisite, Philos 672 or major in mathematics. Mr. Jubien.
681. SELECTED ANCIENT OR MEDIEVAL PHILOSOPHER. Mr. Chappell.
682. SELECTED MODERN CONTINENTAL PHILOSOPHER. Mr. Sleigh.
683. SELECTED MODERN BRITISH PHILOSOPHER. Mr. Aune.
684. CONTEMPORARY PROBLEMS. Mr. Ackermann, Mr. Kiteley, Mr. Smith.
690. SEMINAR.
691. SEMINAR. Mr. Wolff.

Physical Education

(see also EXERCISE SCIENCE)

GRADUATE FACULTY

DAVID C. BISCHOFF, *Dean of the School of Physical Education and Professor*, B.S., Pennsylvania State, 1952; M.Ed., North Carolina, 1953; Ph.D., Pennsylvania State, 1958.

WILLIAM E. RANDALL, JR., *Head of the Department of Recreation and Professor*, B.S., University of Massachusetts, 1949; M.S., University of Wisconsin, 1951; Ph.D., University of Wisconsin, 1952.

BETTY SPEARS, *Acting Head of the Department of Physical Education for Women and Professor*, B.S., Purdue University, 1940; M.S., Wellesley College, 1944; Ph.D., New York University, 1952.

HAROLD J. VANDERZWAAG, *Head of the Department of Physical Education for Men and Professor*, B.A., Calvin College, 1951; M.A., University of Michigan, 1952; Ph.D., University of Michigan, 1962.

MARGARET A. COFFEY, *Professor*, B.S., DePauw University, 1943; M.A., Iowa, 1946; Ph.D., 1963.

ELLEN W. GERBER, *Associate Professor*, B.S., Boston University, 1957; M.Litt., Pittsburgh, 1960; Ph.D., Southern California, 1966.

E. VICKERY HUBBARD, *Associate Professor*, B.S., Wisconsin, 1932; M.A., Chicago, 1951; Ed.D., California, 1961.

GUY M. LEWIS, *Professor*, B.S., East Carolina College, 1950; M.Ed., North Carolina, 1952; Ph.D., Maryland, 1964.

JOHN W. LOY, JR., *Associate Professor*, B.S., Lewis and Clark College, 1961; M.A., Iowa, 1963; Ph.D., Wisconsin, 1967.

C. LYNN VENDIEN, *Associate Professor*, B.S., Eastern Michigan, 1932; M.A., Michigan, 1945; Ed.D., Stanford, 1957.

The School of Physical Education offers a program of study leading to a Master of Science degree in physical education. Students in the M.S. program may concentrate their studies in exercise science (see Exercise Science), sport administration, or sport studies, or they may opt to follow a general program of study.

In sport studies, the student is expected to follow a disciplinary approach, as contrasted with professional preparation. That is, cognate course work is taken in a related discipline, and a thesis is recommended. If the student chooses the sport-administration specialization, it is expected that he or she will follow the non-thesis route and that he cognate course work will be taken in the School of Business Administration.

In addition to the admission requirements of the Graduate School, the School of Physical Education requires an applicant to submit verbal and quantitative scores from the GRE Aptitude Test. The undergraduate preparation which is desired for admission varies with the tract elected by the student. In general, it is recommended that prospective graduate students in sport administration have undergraduate preparation in business administration. Prospective graduate students in sport studies can benefit from taking as many undergraduate courses as possible in the disciplines of history, philosophy, psychology, and sociology.

Thirty or 31 credits are required for graduation in either the thesis or non-thesis route. The requirement is 31 if the student takes Ex Sci 711, Introduction to Research in Human Movement. If the student chooses to do a thesis it is generally for 3 credits, although a student may petition to do a 6-credit thesis. Credits earned within the School are from the courses listed below or those courses which are offered by the Department of Exercise Science.

ALL COURSES CARRY 3 CREDITS UNLESS OTHERWISE SPECIFIED

COURSES OPEN TO GRADUATE STUDENTS ONLY

(For either major or minor credit)

700. SPECIAL PROBLEMS.

Individual research on a topic not covered by other courses. Normally confined to an extension of the content of an existing course rather than an introduction to a new area of study.

Prerequisite, permission of instructor. *Credit, 1-9.*

763. HISTORY OF SCHOOL AND COLLEGE SPORT.

Developments in sport at educational institutions from the age of unorganized play to the present.

Prerequisites, PE 561 or PE 662. *Mr. Lewis.*

772. ATHLETICS: A PHILOSOPHIC INQUIRY.

A critical analysis of those historical, sociological, and psychological factors which have influenced the concept of athletics and caused issues in programs associated with this concept.

Prerequisite, PE 564. *Mr. VanderZwaag.*

782. SEMINAR IN THE SOCIOLOGY OF SPORT.

An analysis of the utility of sociological paradigms, models and theories for the explanation of sport phenomena, including autotelic and agonetic behavior.

Prerequisites, PE 565, one sociological theory course, and one research methods course. *Mr. Loy.*

799. CONTEMPORARY PROBLEMS IN HUMAN MOVEMENT.

Seminar, review, analysis, and evaluation of contemporary problems. A broad review of literature combined with critical analysis of selected items.

800. MASTER'S THESIS.

Credit, 3-6.

834. KINESTHETIC FORM.

The problem of the definition of form in movement as it relates to learning. *Miss Hubbard.*

COURSES OPEN TO BOTH GRADUATE AND UNDERGRADUATE STUDENTS

(For either major or minor credit)

561. WORLD HISTORY OF SPORT.

Factors influencing the rise of sport and the role of sport in society.

Prerequisite, PE 202. *Mr. Lewis.*

564. PHILOSOPHY OF SPORT.

A philosophical analysis of key concepts which influence the objectives and content of various programs in the broad realm of sport.

Prerequisite, PE 203. *Mr. VanderZwaag.*

565. SOCIOLOGY OF SPORT.

Sport as a social institution, including both the structure and function of sport.

Prerequisite, PE 200. *Mr. Loy.*

662. HISTORY OF SPORT IN THE UNITED STATES.

Sport in America from earliest times to the contemporary period. Emphasis on the social, political, and economic factors which affected the development of sport.

Prerequisite, PE 561. *Mr. Lewis.*

663. COMPARATIVE SPORT.

A comparative analysis of sport in selected countries. Emphasis on historical, cultural, and social values affecting the status of sport.

Prerequisite, PE 561. *Miss Vendien.*

Physics

GRADUATE FACULTY

LEROY F. COOK, *Head of the Department of Physics and Astronomy and Professor of Physics*, B.A., California at Berkeley, 1953; M.A., 1957; Ph.D., 1959.

THOMAS T. ARNY, *Associate Professor of Astronomy*, B.A., Haverford, 1961; Ph.D., Arizona, 1965.

JOHN J. BREHM, *Professor*, B.S., Maryland, 1956; M.S., Cornell, 1959; Ph.D., Maryland, 1963.

FREDERICK W. BYRON, *Director of Graduate Studies in Physics and Astronomy and Associate Professor*, B.A., Harvard, 1959; Ph.D., Columbia, 1963.

EDWARD S. CHANG, *Assistant Professor*, B.A., California at Riverside, 1961; M.A., 1964; Ph.D., 1967.

WILLIAM A. DENT, *Assistant Professor of Astronomy*, B.S., Case Institute of Technology, 1960; M.S., University of Michigan, 1962; Ph.D., 1965.

STANLEY ENGELSBERG, *Professor*, B.S., Massachusetts Institute of Technology, 1955; M.A. Harvard, 1957; Ph.D., 1961.

NORMAN C. FORD, *Associate Professor*, B.S., Massachusetts Institute of Technology, 1953; M.A., Syracuse, 1960; Ph.D., California at Berkeley, 1964.

DIETRICH R. FREYTAG, *Associate Professor*, Diploma, University of Bonn, Germany, 1958; Ph.D., 1962.

WILLIAM J. GERACE, *Assistant Professor*, B.S., Massachusetts Institute of Technology, 1963; Ph.D., Princeton, 1967.

ROBERT L. GLUCKSTERN, *Vice Chancellor for Academic Affairs and Professor*, B.E.E., City College of New York, 1944; Ph.D., Massachusetts Institute of Technology, 1948.

H. MARK GOLDENBERG, *Associate Professor*, B.S., California Institute of Technology, 1956; M.S., Harvard, 1957; Ph.D., 1960.

EUGENE GOLOWICH, *Associate Professor*, B.S., Rensselaer Polytechnic Institute, 1961; Ph.D., Cornell, 1965.

ROBERT A. GUYER, *Associate Professor*, B.S., New Mexico State, 1959; Ph.D., Cornell, 1966.

ROBERT B. HALLOCK, *Assistant Professor*, B.S., Massachusetts at Amherst, 1965; M.S., Stanford, 1967; Ph.D., 1969.

EDWARD R. HARRISON, *Professor of Astronomy*, Graduate, Institute of Physics, England, 1949; Associate, 1956; Fellow, 1963.

STANLEY S. HERTZBACH, *Associate Professor*, B.E.S., Johns Hopkins, 1959; Ph.D., 1965.

ALLAN R. HOFFMAN, *Assistant Professor*, B.E. Phys., Cornell, 1959; M.S., Illinois, 1961; Ph.D., Brown, 1966.

BARRY R. HOLSTEIN, *Assistant Professor*, B.S., Carnegie Institute of Technology, 1965; M.S., 1967; Ph.D., Carnegie-Mellon University, 1969.

G. RICHARD HUGUENIN, *Professor of Astronomy*, B.S., Massachusetts Institute of Technology, 1959; Ph.D., Harvard, 1964.

DAVID R. INGLIS, *Professor*, B.A., Amherst, 1928; D.Sc., Michigan, 1931.

WILLIAM M. IRVINE, *Head of the Astronomy Program and Professor of Astronomy*, B.A., Pomona College, 1957; M.A., Harvard, 1958; Ph.D., 1961.

PHILLIPS R. JONES, *Professor*, B.S., Massachusetts, 1951; M.S., Connecticut, 1956; Ph.D., 1959.

JOSEPH W. KANE, *Assistant Professor*, B.S., Wisconsin at Milwaukee, 1961; M.S., Illinois, 1962; Ph.D., 1966.

RICHARD R. KOFLER, *Associate Professor*, B.S., Marquette University, 1958; M.S., Wisconsin, 1960; Ph.D., 1964.

MICHAEL N. KREISLER, *Associate Professor*, B.A., Princeton, 1962; M.S., Stanford, 1963; Ph.D., Stanford, 1966.

ROBERT V. KROTKOV, *Associate Professor*, B.A., Queens University, Canada, 1951; M.S., 1952; Ph.D., Princeton, 1958.

KENNETH H. LANGLEY, *Assistant Professor*, B.S., Massachusetts Institute of Technology, 1958; Ph.D., California at Berkeley, 1966.

RICHARD N. MANCHESTER, *Assistant Professor of Astronomy*, B.S., University of Canterbury, New Zealand, 1964; Ph.D., University of Newcastle, Australia, 1969.

WILLIAM J. MULLIN, *Associate Professor*, B.S., St. Louis University, 1956; Ph.D., Washington University (St. Louis), 1965.

CLAUDE M. PENCHINA, *Associate Professor*, B.E., Cooper Union, 1959; M.S., Syracuse University, 1961; Ph.D., 1964.

GERALD A. PETERSON, *Associate Professor*, B.S., Purdue, 1953; M.S., 1955; Ph.D., Stanford, 1962.

FRANCIS PICHANICK, *Associate Professor*, B.S., University of Capetown, South Africa, 1957; M.S., 1958; Ph.D., Oxford University, England, 1961.

ARTHUR R. QUINTON, *Professor*, B.S., Queen Mary College, London University, England, 1944; M.S., University of Western Ontario, Canada, 1951; Ph.D., Yale, 1954.

MONROE S. RABIN, *Associate Professor*, B.A., Columbia, 1961; M.S., Rutgers, 1964; Ph.D., Rutgers, 1967.

PHILIP ROSEN, *Professor*, B.S., City College of New York, 1944; M.S., Yale, 1946; Ph.D., 1949.

KANDULA S. R. SASTRY, *Associate Professor*, B.S., Andhra University, India, 1955; M.S., 1956; Ph.D., Indiana, 1962.

CLAUDE SCHULTZ, *Associate Professor*, B.A., California at Berkeley, 1957; Ph.D., 1964.

JANICE BUTTON SHAFER, *Professor*, B.E.P., Cornell, 1954; Ph.D., California at Berkeley, 1959.

EDWARD A. SOLTYSIK, *Professor*, B.S., Lafayette, 1950; M.S., Indiana, 1952; Ph.D., 1956.

MORTON M. STERNHEIM, *Professor*, B.S., City College of New York, 1954; M.S., New York University, 1956; Ph.D., Columbia, 1961.

JOHN D. STRONG, *Professor of Astronomy*, B.A., Kansas, 1926; Ph.D., Michigan, 1930.

ARTHUR R. SWIFT, *Associate Professor*, B.A., Swarthmore, 1960; Ph.D., Pennsylvania, 1964.

EUGENE TADEMARU, *Assistant Professor of Astronomy*, B.S., University of Illinois, 1964; Ph.D., University of Chicago, 1969.

JOSEPH H. TAYLOR, JR., *Assistant Professor of Astronomy*, B.A., Haverford, 1963; Ph.D., Harvard, 1968.

DAVID J. VAN BLERKOM, *Assistant Professor of Astronomy*, B.S., City College of New York, 1963; Ph.D., Colorado, 1969.

JAMES F. WALKER, *Assistant Professor*, B.S., Minnesota, 1959; M.S., 1961; Ph.D., 1964.

RANDY R. WHITNEY, *Assistant Professor*, B.A., University of Oregon Honors College, 1966; Ph.D., Stanford, 1971.

Graduate degrees are offered in both physics and astronomy by the Department. Candidates planning to major in astronomy are referred to the description of the astronomy program (see Astronomy).

The general requirements for the Ph.D. in Physics are those of the Graduate School. These are implemented along the following lines. During the first two years, a student takes a normal load of basic courses. The basic courses of the program are 701, 702, 703, 704, 705, 706, 707, 709, 710, 714, 715, 718, 719. The student must complete a research requirement of three research-oriented courses. Two of these must be outside of the student's area of

specialization. After passing the qualifying examination the student will be expected to devote his major effort to research. Courses taken during this period will usually be in the student's research field. The department requires no foreign-language reading competency for the doctorate.

The requirements for the master's degree consist of 30 graduate credits, at least 15 of which shall be in the 700-900 courses, and at least 21 of which shall be in physics. The 15 credits of 700-900 courses shall include one course in the basic Quantum Mechanics sequence or its equivalent, and may include 6 credits of master's thesis, Physics 800. At least five courses in physics must be passed with a grade of A or B, and a general examination must be passed before the degree is awarded.

Candidates planning to major in physics should have completed at least (preferably, more than) 15 semester credit hours in undergraduate physics beyond an introductory course (such as Physics 161, 162, 163) and also 6 credits of mathematics beyond college-level calculus.

ALL COURSES CARRY 3 CREDITS UNLESS OTHERWISE SPECIFIED

COURSES OPEN TO GRADUATE STUDENTS ONLY

700. INDEPENDENT STUDY.

Special study in some branch of physics, either theoretical or experimental, under direction of a faculty member. A written proposal must be submitted to that faculty member and to the Head of the Department for approval prior to registration.

701. CLASSICAL MECHANICS.

Lagrange's and Hamilton's equations, central force problem, rigid bodies, small oscillations, continuum mechanics, fluid dynamics.

Prerequisites, Physics 552, 556, and Math 241.

702. STATISTICAL PHYSICS.

Survey of thermodynamics, Boltzmann distribution, statistical interpretation of thermodynamics, Gibbsian ensembles and the method of Darwin, Fowler; quantum distributions and their applications, transport phenomena. Prerequisites, Physics 701, 703, and 706 (the latter may be taken concurrently).

703. INTRODUCTORY QUANTUM MECHANICS I.

Breakdown of classical physics, wave mechanics including the Schrodinger equation and its interpretation, one-dimensional problems, uncertainty principle, harmonic oscillator, hydrogen atom.

Prerequisites, Physics 701 and 705 (both may be taken concurrently).

704. INTERMEDIATE QUANTUM MECHANICS II.

Abstract quantum mechanics, linear algebra and Hilbert space, representation theory, three-dimensional problems, orbital angular momentum spins, vector coupling.

Prerequisites, Physics 703, or equivalent.

705. METHODS OF MATHEMATICAL PHYSICS.

Selected topics with application to physics in linear algebra and Hilbert space theory, complex variables, Green's functions, partial differential equations, integral transforms, integral equations. *Credit, 4.*

706. CLASSICAL ELECTRODYNAMICS I.

Electrostatic fields in vacuum and material media, two and three dimensional potential problems, the magnetostatic field, interaction of steady currents, Maxwell's

equations, the electromagnetic field, special relativity, and covariant formulation of electrodynamics.

Prerequisites, Physics 701 and 705.

707. CLASSICAL ELECTRODYNAMICS II.

The field of a moving charge, the Lienard-Wiechert potentials, Lorentz transformation and special relativity, covariant formulation of Maxwell's equations. Radiation of electromagnetic waves; the near field and far field, radiation damping and self fields, spectral resolution of radiation. Magnetohydrodynamics and plasma physics, collisions, scattering and absorption.

Prerequisite, Physics 706.

709. INTERMEDIATE QUANTUM MECHANICS III.

Approximation methods, WKB, bound State Perturbation theory, time-dependent perturbation theory, variational method, selfconsistent techniques, scattering theory.

Prerequisite, Physics 704.

710. ADVANCED QUANTUM MECHANICS IV.

Semi-classical radiation theory, non-relativistic second quantization, advanced scattering theory; relativistic wave-equations.

Prerequisite, Physics 709.

714. INTRODUCTORY HIGH ENERGY PHYSICS.

General introduction to the physics of elementary particles treating invariance principles, analysis of π -N scattering, strange particles, final state interactions and resonances, internal symmetries, introduction to the theories of strong, electromagnetic, and weak interactions.

Prerequisite, Physics 709.

715. INTRODUCTORY SOLID STATE PHYSICS.

Solids treated as translational symmetry structures, and their effect in x-ray and particle scattering, thermal and vibrational properties of solids. Binding energy of solids, electronics in periodic potentials, and the formation of bands. The free electron model of metals.

Prerequisite, Physics 704.

717. PLASMA PHYSICS.

Properties of plasma, equation of motion, particle versus continuum description, magnetohydrodynamics, stabilities, linear theory of waves and oscillations. Landau damping, non-linear effects and transport phenomena.

Prerequisites, Physics 702, 707.

718. BASIC PHYSICS OF ATOMS AND MOLECULES.

Quantum description of free atoms and molecules and their interactions with external fields, radiation, and electrons.

719. NUCLEAR PHYSICS.

Basic concepts of nuclear physics, instruments and methods. Topics include natural radioactivity, nuclear radiations—their properties and interaction with matter, nuclear-radiation detectors, electrostatic and magnetic analyzers, mass spectrometry, charged particle accelerators, elementary discussion of alpha and beta decay, nuclear isomerism, internal conversion, nuclear reactions, neutron physics, fissions, nuclear spin and magnetic moments, cosmic rays and elementary particles.

Prerequisite, Physics 703 or equivalent.

720. RADIATION PHYSICS.

The interaction of radiation with matter; atomic processes, particle properties, radioactive decay, energy loss, detectors, nuclear reactions, neutron physics. Special topics.

Three-hour laboratory once every two weeks. *Credit, 4.*

723. TOPICS IN MATHEMATICAL PHYSICS.

Subjects vary somewhat depending on the instructor, but probably include applications of the theory of functions,

group theory and symmetries, Hilbert and Banach spaces in quantum mechanics.
Prerequisites, Physics 705 and permission of instructor.

724. GROUP THEORY IN QUANTUM MECHANICS.

Finite dimensional groups and their representations; representations of the permutation group; representations of SU_n , tensor representations, decomposition of direct product representations; three-dimensional rotation group, Clebsch-Gordon and Racah coefficients; the Lorentz group and its representations; applications to atomic, solid state, nuclear, and high energy physics.
Prerequisite, Physics 709.

811 (I), 812 (II). FIELD THEORY.

Relativistic quantum mechanics of a single particle, Klein-Gordon and Dirac equations, formal scattering theory, field quantization, interacting fields, S-matrix, reduction formulae, perturbation theory and Feynman diagrams renormalization, dispersion relations, and recent developments.
Prerequisites, Physics 709 (may be taken concurrently) for 811; Physics 811 for 812.

813. HIGH ENERGY PHYSICS.

Experimental and theoretical aspects of: meson and baryon resonances; leptonic and non-leptonic, strangeness changing and non-changing weak decays; high energy experiments and the phenomenology of Regge poles.
Topics vary with the instructor.
Prerequisite, Physics 714.

816. SOLID STATE PHYSICS.

Transport phenomena in solids including semiconductors, optical properties of solids, superconductivity, superfluidity, magnetism. Topics vary with the instructor.
Prerequisite, Physics 715.

817. ADVANCED STATISTICAL PHYSICS.

Phase transitions, including condensation; description of imperfect gases. Transport theory and other nonequilibrium phenomena. Irreversible processes. Field theoretic quantum statistical physics.
Prerequisites, Physics 702, 811.

818. ATOMIC STRUCTURE.

An advanced course covering the field of atomic structure including the theory of complex spectra, fine structure, hyperfine structure, electron spin, Zeeman effect, the theory of atomic collisions, general theory of multiplets and magnetic and radiative properties of atoms.
Prerequisite, Physics 709.

820. NUCLEAR THEORY.

A theoretical understanding of nuclear structure. Topics include internucleon forces, the deuteron and the two-body problem, nuclear models and structure of complex nuclei, electromagnetic properties of nuclei, theory of alpha and beta decay, theory of nuclear reactions.
Prerequisites, Physics 709 and 719.

821. RELATIVITY.

Mathematical and conceptual aspects of the special and general theories of relativity. Lorentz transformations, covariant formulation of the laws of nature. The equivalence principle, curved spaces, solutions of the equations of relativity.
Prerequisites, Physics 701, 706.

850. ADVANCED TOPICS IN PHYSICS.

One or more subjects of special interest covered in lectures.
Prerequisite, permission of instructor.

851. SPECIAL TOPICS IN NUCLEAR PHYSICS.
Advanced and current topics in nuclear physics.
Prerequisite, Physics 820.

852. SPECIAL TOPICS IN HIGH ENERGY PHYSICS.
Advanced and current topics in high energy physics.
Prerequisite, Physics 813.

853. SPECIAL TOPICS IN SOLID STATE PHYSICS.
Advanced and current topics in solid state physics.
Prerequisite, Physics 816.

854. SPECIAL TOPICS IN ATOMIC PHYSICS.
Advanced and current topics in atomic physics.
Prerequisite, Physics 818.

860. SEMINAR ON RESEARCH TOPICS.
Instruction via reading assignments and seminars on research topics not currently covered in regular courses.
Prerequisite, permission of instructor. *Credit, 1-3.*

800. MASTER'S THESIS. *Credit, 6.*

900. DOCTORAL DISSERTATION. *Credit, 30.*

COURSES OPEN TO BOTH GRADUATE AND UNDERGRADUATE STUDENTS

(For either major or minor credit)

564. WAVE MOTION.

Physical optics, acoustics, and other wave phenomena in a single unified structure.
Prerequisite, Physics 552.

571 (I), 572 (II). STATISTICAL PHYSICS.

Thermodynamics, kinetic theory, and statistical mechanics in a single unified structure.
Prerequisites, Physics 552, 556. *Credit, 3 each semester.*

585. MODERN PHYSICS I.

Review of classical mechanics, theory of relativity, black body radiation, photoelectric effect, Compton effect, background for development of quantum mechanics, Bohr atom.
Prerequisites, Physics 552, 556.

586. MODERN PHYSICS II AND QUANTUM MECHANICS.

Quantum mechanics, applications to atomic and nuclear physics, such as atomic spectra, Zeeman effect, angular momentum, barrier penetration.
Prerequisite, Physics 585. *Credit, 4.*

588. SOLID STATE PHYSICS.

An introduction to theoretical and experimental physics of the solid state.
Prerequisite, Physics 585.

619. ELECTRONICS INSTRUMENTATION.

A laboratory-oriented course designed expressly for physicists and chemists. Basic electronics principles, servo systems, operational amplifiers, digital circuits, other modern devices.
Prerequisite, permission of instructor.

685 (I), 686 (II). ADVANCED EXPERIMENTAL WORK.

Selected experiments and projects, according to the needs of individual student.
Prerequisite, Physics 551. *Credit, 1 to 3 each semester.*

(For major credit subject to approval of Graduate Studies Committee)

551. ELECTRICITY AND MAGNETISM I.

Classical field theory, static electric fields and magnetic

fields of steady currents. Scalar and vector potentials, Laplace's equation and its solutions.
Prerequisites, Physics 142 or 162 or 183; Math 174 or 186.

552. ELECTRICITY AND MAGNETISM II.
Continuation of 551. Time varying fields, Maxwell's equations, and applications to radiation.
Prerequisites, Physics 551 and Math 187 or 343.

555 (I), 556 (II). MECHANICS.
Development of the fundamental concept of dynamics with applications to particles and rigid bodies in translation and rotation.
Prerequisites, Physics 142, 162 or 184; Math 174 or 186.
Credit, 3 each semester.

Plant Pathology

GRADUATE FACULTY

RICHARD A. ROHDE, *Head of the Department of Plant Pathology and Professor*, Drew University, 1951; M.S., Maryland, 1956; Ph.D., 1958.

GEORGE N. AGRIOS, *Associate Professor*, B.S., University of Thessaloniki, Greece, 1957; Ph.D., Iowa State, 1960.

WILLIAM A. FEDER, *Professor*, B.A., Johns Hopkins, 1941; Ph.D., California at Berkeley, 1950.

CONSTANTINE J. GILGUT, *Professor*, B.S., Massachusetts, 1931; M.S., 1934; M.A., Harvard, 1937; Ph.D., 1942.

FRANCIS W. HOLMES, *Professor*, B.A., Oberlin, 1950; Ph.D., Cornell, 1954.

WILLIAM J. MANNING, *Assistant Professor*, B.S., Michigan State, 1963; M.S., Delaware, 1966; Ph.D., 1968.

MALCOLM A. MCKENZIE, *Professor and Director of Shade Tree Laboratories*, Ph.B., Brown, 1926; M.A., 1926; Ph.D., 1935.

MARK S. MOUNT, *Assistant Professor*, B.S., Illinois Wesleyan, 1963; M.S., Michigan State, 1965; Ph.D., 1968.

WILLIAM N. RICE, *Associate Professor*, B.A., Sioux Falls College, 1936; Iowa State, 1939; Ph.D., 1944.

BERT M. ZUCKERMAN, *Professor*, B.S., North Carolina State, 1948; M.S., N.Y. State College of Forestry, 1949; Ph.D., Illinois, 1954.

Students accepted for graduate study towards the Master of Science or Doctor of Philosophy degree are expected to have fulfilled the usual requirements for a bachelor's degree in a related discipline. Requirements for the M.S. degree ordinarily include a thesis, but course work, including Plant Pathology 700, may be substituted with permission of the adviser and Graduate Studies Committee. Facilities at the Suburban Experiment Station, Waltham, and the Cranberry Experiment Station, East Wareham, are available for projects in special areas. The department has no foreign-language requirement.

UNIVERSITY OF MASSACHUSETTS

ALL COURSES CARRY 3 CREDITS UNLESS OTHERWISE SPECIFIED

COURSES OPEN TO GRADUATE STUDENTS ONLY

(For either major or minor credit)

700. SPECIAL PROBLEMS.
Selected research problems in plant pathology.
Credit, 1-5.

790. SEMINAR.
Reports and discussion on the current literature and research in plant pathology; special reports by resident and visiting speakers.
One class hour.
Credit, 1 each semester.

800. MASTER'S THESIS.
Credit, 10.

804. FOREST PATHOLOGY.
The diseases of trees and the decay of forest products.
Prerequisites, Plant Path 551 and Botany 531.

805. ADVANCED PLANT PATHOLOGY—PARASITISM AND PATHOGENESIS.
The physiology of diseased plants and the nature of host-parasite interactions. Emphasis on the biochemical and physiological changes induced in the host by plant pathogens. Laboratory consists of biochemical investigations of diseased plants.
Prerequisite, Plant Path 551. *Credit, 4.* Mr. Mount.

806. ADVANCED PLANT PATHOLOGY—EPIPHYTOLOGY.
The interactions of host, parasite, and environment in the rise and decline of devastating epiphytotics. The mechanisms that govern disease disposition, disease-resistance, and immunity.
Prerequisites, Botany 531 and Plant Path 551.

900. DOCTORAL DISSERTATION. *Credit, 30.*

COURSES OPEN TO BOTH GRADUATE AND UNDERGRADUATE STUDENTS

(For either major or minor credit)

551. PLANT PATHOLOGY.
The nature, causes, and control of plant diseases.
Prerequisite, a course in Botany. Mr. Agrios.

569. FOREST AND SHADE TREE PATHOLOGY.
The nature, cause, and control of the principal types of disease in trees, including decay of forest products and of standing and structural timber.

575. METHODS IN PLANT PATHOLOGY.
General techniques and specialized methods used in the investigation of plant diseases.
Prerequisite, one semester of Plant Pathology.

640. GENETICS OF PLANT-PATHOGEN INTERACTION.
Characterization of genetic factors which control plant disease reaction and virulence. Included will be the influence of environment on genetic stability of pathogens. Mutations and parasexuality as a factor in pathogenic variation, and plant population genetics in relation to disease development.
Prerequisite, Plant Path 251 or 551. Mr. Mount.

661. PLANT VIROLOGY.
Structure and properties of plant viruses. Virus transmission. Virus infection and synthesis. Symptomatology and physiology of virus-infected plants. Assay and purification of plant viruses. Identification and control of plant viruses.
Prerequisite, Plant Path 251 or 551 or permission of instructor. *Credit, 4.* Mr. Agrios.

678. NEMATOLOGY.

Anatomy, morphology, and classification of plant-parasitic and other soil-inhabiting nematodes. Parasitic relationships with plants and current control-measures stressed.

Prerequisite, a year of biological science.

Credit, 4. Mr. Rohde.

680. BIOLOGICAL TRANSMISSION OF PLANT DISEASES.

The intricate interrelationships between insects, plants, microorganisms, and environment are considered in relation to the various roles played by arthropods in the inception, transmission, and perpetuation of plant diseases.

Prerequisite, a year of biological science.

Plant and Soil Sciences

GRADUATE FACULTY

FRANKLIN W. SOUTHWICK, *Head of the Department of Plant and Soil Sciences and Professor of Plant Science*, B.S., Massachusetts, 1939; M.S., Ohio State, 1940; Ph.D., Cornell, 1943.

JOHN H. BAKER, *Associate Professor of Soil Science*, B.S., Massachusetts, 1952; M.S., Cornell, 1954; Ph.D., 1959.

ALLEN V. BARKER, *Associate Professor of Plant and Soil Science*, B.S., Illinois, 1958; M.S., Cornell, 1959; Ph.D., 1962.

ALFRED W. BOICOURT, *Professor of Plant Science*, B.S., Cornell, 1938; M.S., 1941.

WILLIAM J. BRAMLAGE, *Associate Professor of Plant Science*, B.S., Ohio State, 1959; M.S., Maryland, 1961; Ph.D., 1963.

WILLIAM G. COLBY, *Professor of Plant and Soil Science*, B.S., Illinois, 1929; M.S., Rutgers, 1932; Ph.D., 1934.

MACK DRAKE, *Professor of Plant and Soil Science*, B.S., Purdue, 1937; M.S., Purdue and Alabama Polytechnic, 1939; Ph.D., 1946.

WALTON C. GALINAT, *Professor of Environmental Sciences*, Suburban Experiment Station, Waltham, Mass., Ph.D., University of Wisconsin, 1953.

GEORGE B. GODDARD, *Associate Professor of Plant Science*, B.S., Massachusetts, 1954; M.S., 1958; Ph.D., 1963.

DUANE W. GREENE, *Professor of Plant Science*, B.S., Colgate University, 1964; M.S., Michigan State University, 1966; Ph.D., 1969.

HAIM B. GUNNER, *Professor of Environmental Sciences*.

JOHN R. HAVIS, *Professor of Plant Science*, B.S., Texas Technological College, 1942; M.S., Cornell, 1947; Ph.D., 1949.

PAUL H. JENNINGS, *Assistant Professor of Plant Science*, B.V.A., Massachusetts, 1960; M.S., North Carolina State University, 1962; Ph.D., 1965.

WILLIAM H. LACHMAN, *Professor of Plant Science*, B.S., Pennsylvania State, 1934; M.S., 1936.

WILLIAM J. LORD, *Professor of Plant Science*, B.S., New Hampshire, 1943; M.S., 1953; Ph.D., Pennsylvania State, 1955.

HERBERT V. MARSH, *Associate Professor of Plant Science*, B.S., Massachusetts, 1954; M.S., 1958; Ph.D., North Carolina State University, 1961.

DONALD N. MAYNARD, *Professor of Plant Science*, B.S., Connecticut, 1954; M.S., North Carolina State College, 1956; Ph.D., Massachusetts, 1963.

JOHN T. REYNOLDS, *Adjunct Professor of Environmental Sciences*, Biology Department, Clark University, Worcester, Mass.

WILLIAM A. ROSENAU, *Associate Professor of Plant and Soil Science*, B.S., Yale, 1948; M.S., Connecticut, 1950; Ph.D., Pennsylvania State, 1961.

GORDON L. STEWART, *Associate Professor of Soil Science*, B.S., Utah State, 1955; M.S., 1957; Ph.D., Washington State University, 1962.

CECIL L. THOMSON, *Professor of Plant Science*, B.S.A., University of Toronto, 1937; M.S., University of Minnesota, 1945.

JOSEPH TROLL, *Professor of Plant Science*, B.S., Rhode Island, 1954; M.S., 1957; Ph.D., Massachusetts, 1965.

JONAS VENGRIS, *Professor of Plant Science*, Diploma, Agr. College, Lithuania, 1934; 1936; Dr. Agr. Sci., University of Bonn, Germany, 1939.

MARTIN E. WEEKS, *Professor of Plant and Soil Science*, B.S., South Dakota State, 1934; Ph.D., Wisconsin, 1937.

JOHN M. ZAK, *Associate Professor of Plant and Soil Science*, B.S., Massachusetts, 1936; M.S., 1938.

The Department of Plant and Soil Sciences offers doctoral work in either Plant Science or Soil Science. Specialization and thesis problems related to horticultural and agronomic plants and in soil science are available to both Master of Science and Doctor of Philosophy degree candidates.

The department has no foreign-language requirement for the doctoral degree.

ALL COURSES CARRY 3 CREDITS UNLESS OTHERWISE SPECIFIED

COURSES OPEN TO GRADUATE STUDENTS ONLY

(For either major or minor credit)

700, 701. SPECIAL PROBLEMS.

Selected research problems not related to a candidate's thesis. *Credit, 3 each semester.*

702, 703. RESEARCH LITERATURE.

A critical review of the scientific literature in an area of specialization. *Credit, 3 each semester.*

710. MORPHOLOGY OF ECONOMIC PLANTS.

The anatomy of the plant body with emphasis on those structures which have horticultural and agronomic significance.

Prerequisite, Botany 291 or permission of instructor. *Mr. Goddard.*

713. CLAY MINERALOGY.

Structure of clay minerals; identification, weathering, and alteration of minerals; properties of clay surfaces; geotechnical studies of clays in geology, soil science, and soil mechanics.

Prerequisite, permission of instructor.

715. PLANT GROWTH REGULATORS.

Recent advances in the field of plant growth regulators; including phytochromes, auxins, gibberellins, kinins and herbicides. Emphasis on investigations of the mechanisms whereby these materials control plant growth and development.

Prerequisites, Botany 511 and one semester of biochemistry. Mr. Marsh, Mr. Greene.

717. PLANT-WATER RELATIONSHIPS.

Contemporary concepts of the distribution, movement, and function of water in plants. Soil and atmospheric factors in the development of plant-water stress and its significance to physiological processes.

Prerequisites, Botany 511 or permission of instructor.

Mr. Havis.

730. ADVANCED SOIL CHEMISTRY.

The chemistry of soil formation, soil acidity, nutrient element availability, ionic exchange, and fixation, soil-plant microorganism relationships, and relationships of organic matter of the soil. Laboratory work consists of physical, analytical and biochemical investigations of soils and important soil constituents.

Prerequisite, permission of instructor.

Mr. Baker.

745. MICROBIAL ECOLOGY OF THE SOIL.

The biochemistry and physiology of interaction among microorganisms in the soil environment, and their relationship with the soil environment. Lectures, discussion, and a critical review of current literature.

Prerequisite, Plant and Soil Sci 585 or permission of instructor.

Mr. Gunner.

750. PLANT PHOTOSYNTHESIS.

Lectures and discussions of the mechanisms, requirements, evolution, and specific related processes. Extensive study of the basic literature required.

Prerequisite, Botany 512, or Chem 524, or equivalent.

Mr. Barker.

760. NITROGEN METABOLISM.

A comprehensive presentation of nitrogen metabolism in plants. The biological mechanisms of nitrogen absorption, synthesis, and degradation of nitrogenous compounds, nitrogen fixation, specific roles of nitrogenous compounds and nitrogen toxicities.

Prerequisite, Botany 512, or Chem 524, or equivalent.

Mr. Barker.

791. SEMINAR.

Required of all graduate students majoring in the Department.

Credit, 1 each semester.

800. MASTER'S THESIS.

Credit, 10.

900. DOCTORAL DISSERTATION.

Maximum credit, 30.

COURSES OPEN TO BOTH GRADUATE AND UNDERGRADUATE STUDENTS

(For either major or minor credit)

530. PLANT NUTRITION.

The accumulation and transport of inorganic ions in plants and their function in plant metabolism.

Prerequisite, Botany 211 or equivalent. Mr. Maynard.

535. TAXONOMY OF ECONOMIC PLANTS.

Plant families, genera, species, and cultivars of importance in the horticultural and agronomic fields.

Mr. Boicourt.

540. PLANT BREEDING.

An advanced study of genetic topics peculiar to plants; the methods and problems of the plant breeder.

Prerequisite, Zool 240 or equivalent. Mr. Lachman.

545. POST-HARVEST PHYSIOLOGY.

Physical and chemical processes of plants before and after harvest and the influence of environmental, chemical, and storage factors on these processes.

Mr. Bramlage.

550. FORAGE AND FIELD CROPS.

Analysis of the principles involved in the establishment, fertilization, and harvest management of forage and field crops.

Mr. Colby.

555. AGROSTOLOGY.

The establishment and maintenance of turf grasses used on lawns, athletic fields, highways, airports, and cemeteries.

Mr. Troll.

560. ECOLOGY AND CONTROL OF WEEDS.

Identification and ecology of common weeds and principles of weed control with emphasis on the use of chemical herbicides.

Mr. Vengris.

565. SOIL FORMATION AND CLASSIFICATION.

The development of soils as related to physical, chemical, biological, climatic, and geological factors.

Credit, 4. Mr. M. Weeks.

570. SOIL PHYSICS.

Physical properties of soil, including textural, structural, water, air, and temperature relationships; their measurements, evaluation, and influence in the soil system.

Prerequisite, Plant and Soil Sci 105 or equivalent.

Mr. Stewart.

575. SOIL CHEMISTRY.

The inorganic and organic chemical reactions related to the nutrient supply in soils and soil nutrition of plants. Colloidal aspects of soil chemical reactions and soil-plant mineral relationships.

Prerequisites, Chem 127 and Plant and Soil Sci 265 or equivalent.

Mr. Baker.

580. SOIL-PLANT MINERAL NUTRITION.

Mineral nutrients in the growth of plants; the use of fertilizers and other soil amendments; soil reaction; mineral deficiencies and toxicities in plants.

Mr. Drake.

585. MICROBIOLOGY OF THE SOIL.

Soil microorganisms; their distribution, ecology and transformation of organic and inorganic substrates. Microbiology of the rhizosphere and the biological equilibrium.

Prerequisite, Microbiol 250 or permission of instructor.

Mr. Gunner.

Political Science

GRADUATE FACULTY

GLEN GORDON, *Chairman of the Department of Political Science and Associate Professor*, B.A., New York University, 1952; M.A., Chicago 1957; Ph.D., 1963.

GERARD BRAUNTHAL, *Director of Graduate Studies in Political Science and Professor*, B.A., Queens College, 1947; M.A., Michigan, 1948; Ph.D., Columbia, 1953.

DEAN ALFANGE, JR., *Dean of Faculty of Social and Behavioral Sciences and Associate Professor*, B.A., Hamilton, 1950; M.A., Colorado, 1960; Ph.D., Cornell, 1967.

LUTHER A. ALLEN, *Professor*, B.A., Williams, 1941; M.A., State University of Iowa, 1942; Ph.D., Chicago, 1952.

STANLEY BACH, *Assistant Professor*, B.A., Chicago, 1966; M. Phil., Yale, 1969; Ph.D., 1972.

- LOREN P. BETH, *Professor*, B.A., Monmouth College, 1946; M.A., Chicago, 1948; Ph.D., 1949.
- DAVID A. BOOTH, *Professor*, B.S., London School of Economics, 1952; M.A., Virginia, 1953; Ph.D., 1957.
- WILLIAM E. CONNOLLY, *Associate Professor*, B.A., Michigan (Flint), 1960; M.A., Michigan, 1962; Ph.D., 1965.
- PHILIP B. COULTER, *Associate Professor*, B.A., Centre College, 1961; Ph.D., State University of New York (Albany), 1966.
- PATRICK EAGAN, *Assistant Professor*, B.S., Regis, 1952; M.A., Colorado State, 1955; Ph.D., University of California, Riverside, 1971.
- ERIC EINHORN, *Assistant Professor*, B.A., Pennsylvania, 1965; M.A., Harvard, 1968; Ph.D., 1972.
- EDWARD E. FEIT, *Associate Professor*, B.A., Witwatersrand, 1944; M.A., University of South Africa, 1949; Ph.D., Michigan, 1965.
- JOHN H. FENTON, *Commonwealth Professor of Government*, B.A., Kentucky, 1948; M.A., 1951; Ph.D., Harvard, 1956.
- PETER J. FLESS, *Professor*, B.A., Stanford, 1944; M.A., Harvard, 1947; Ph.D., 1951.
- HARVEY L. FRIEDMAN, *Associate Professor*, J.D., Boston University, 1947.
- EDWIN ANDRUS GERE, JR., *Associate Professor*, B.A., Alfred, 1948; M.A., Pennsylvania State, 1956; Ph.D., State University of New York (Albany), 1968.
- SHELDON GOLDMAN, *Associate Professor*, B.A., New York University, 1961; M.A., Harvard, 1964; Ph.D., 1965.
- JOHN S. HARRIS, *Commonwealth Professor of Government*, B.S., University of Richmond, 1939; M.A., William and Mary, 1941; M.S., Syracuse, 1942; Ph.D., Chicago, 1951.
- FRANKLIN W. HOUN, *Professor*, B.A., National Chenchu University, 1946; M.A., Denver, 1950; Ph.D., Wisconsin, 1953.
- IRVING HOWARDS, *Professor*, B.A., Wisconsin, 1953; M.A., 1955; Ph.D., 1957.
- JEROME B. KING, *Associate Professor*, B.A., Dartmouth, 1949; M.A., Stanford, 1954; Ph.D., 1958.
- HARVEY KLINE, *Assistant Professor*, B.A., North Carolina, 1966; Ph.D., Texas, 1970.
- FRED A. KRAMER, *Assistant Professor*, B.A., Johns Hopkins University, 1963; M.A., Rutgers University, 1964; Ph.D., Syracuse University, 1969.
- JOHN W. LEDERLE, *Joseph B. Ely Professor*, B.A., Michigan, 1933; M.A., 1934; I.L.B., 1936; Ph.D., 1942.
- CUENTER LEWY, *Professor*, B.S.S., City College of New York, 1951; M.A., Columbia, 1952; Ph.D., 1957.
- LEWIS C. MAINZER, *Professor*, B.A., New York University, 1948; M.A., Chicago, 1950; Ph.D., 1956.
- JOHN M. MAKI, *Professor*, B.A., Washington, 1932; M.A., 1936; Ph.D., Harvard, 1948.
- LEILA MEO, *Associate Professor*, B.A., American University at Cairo, 1947; M.A., Syracuse, 1949; Ph.D., Indiana, 1961.
- JEROME M. MILEUR, *Assistant Professor*, B.A., Southern Illinois, 1955; M.A., University of Illinois, 1958; Ph.D., Southern Illinois, 1971.
- FELIX E. OPPENHEIM, *Professor*, 'Docteur-en-droit', Brussels, 1938; Ph.D., Princeton, 1942.
- KARL W. RYAVEC, *Associate Professor*, B.A., Miami University, 1957; M.A., Columbia, 1962; Ph.D., 1968.
- ROBERT ANTHONY SHANLEY, *Associate Professor*, B.A., Columbia, 1946; M.A., 1948; Ph.D., Georgetown, 1955.
- HANS SPEIER, *Robert Morrison MacIver Professor of Political Science and Sociology*, Ph.D., Heidelberg, 1928.
- HERBERT F. STEEPER, *Associate Professor*, B.A., Stanford University, 1954; M.A., Fletcher School, 1961; Ph.D., 1967.
- GEORGE T. SULZNER, *Assistant Professor*, B.A., Muskingum College, 1959; M.A., Michigan, 1961; Ph.D., 1967.
- ANWAR H. SYED, *Professor*, B.A., University of the Punjab, 1946; M.A., 1951; M.A., Chicago, 1953; M.A., Pennsylvania, 1954; Ph.D., 1957.
- FERENC A. VALI, *Professor*, Doctor Juris, Budapest, 1927; Ph.D., London, 1932.
- HOWARD J. WIARDA, *Associate Professor*, B.A., Michigan, 1961; M.A., Florida, 1962; Ph.D., 1965.

The Department of Political Science offers graduate work leading to the Master of Arts, Master of Public Administration, and Doctor of Philosophy degrees. Detailed information on requirements for degrees may be obtained from the Department of Political Science.

The Department's courses are categorized in eight subfields. In most of these subfields there is a pro-seminar which prepares beginning students for the more specialized advanced seminars by acquainting them with the fundamental concepts, theories, modes of inquiry, and research findings in a subfield. In all eight subfields there are tutorials and directed studies courses. The tutorial is basically a reading course, the content and format of which are arranged by agreement of one or more students and a professor. Generally, a tutorial treats a topic of their mutual interest which is not adequately covered by existing courses. The directed studies course is a specialized advanced seminar with regular meetings which covers a topic not covered in other seminars. It is an in-depth study of a particular aspect of a subfield, the content of which varies with the interests of professors and students.

ALL COURSES CARRY 3 CREDITS UNLESS OTHERWISE SPECIFIED

COURSES OPEN TO GRADUATE STUDENTS ONLY

700-709. AMERICAN GOVERNMENT AND POLITICS.

700. PROSEMINAR IN AMERICAN GOVERNMENT AND POLITICS.

701. TUTORIAL IN AMERICAN GOVERNMENT AND POLITICS.

702. DIRECTED STUDIES IN AMERICAN GOVERNMENT AND POLITICS.

703. LEGISLATIVE BEHAVIOR.

Selected topics in American legislative systems, national and state; attention to major research techniques and recent theoretical developments.

704. AMERICAN POLITICAL PARTY SYSTEMS.
The structure and activities of American parties and their impact on individual and group political behavior and on government and public policy. Focus on both national and state party systems. Mr. Fenton.

710-19. COMPARATIVE POLITICS.

710. PROSEMINAR IN COMPARATIVE POLITICS.

711. TUTORIAL IN COMPARATIVE POLITICS.

712. DIRECTED STUDIES IN COMPARATIVE POLITICS.

713. COMPARATIVE POLITICAL PARTIES.
The ideology, structure, and dynamics of diverse types of political parties, party systems, and electoral systems; their interrelationships.

714. MILITARY POLITICS.
Comparative study of contemporary problems in civilian-military relations. Mr. Feit.

720-729. INTERNATIONAL RELATIONS.

720. PROSEMINAR IN INTERNATIONAL RELATIONS.

721. TUTORIAL IN INTERNATIONAL RELATIONS.

722. DIRECTED STUDIES IN INTERNATIONAL RELATIONS.

723. PROBLEMS OF INTERNATIONAL RELATIONS.
Analysis of major problems in international relations. Mr. Braunthal, Mr. Fliess, Mr. Vali.

724. INTERNATIONAL LAW AND ORGANIZATION.
Analysis of major problems in international law and organization. Mr. Vali.

725. THEORY OF INTERNATIONAL POLITICS.
Analysis and conceptualization of the forces and drives that condition politics among nations. Mr. Fliess.

726. NATIONALISM.
Analysis of nationalism as a political ideology with emphasis on its role in emergent nations. Mr. Fliess.

727. IMPERIALISM.
Analysis of imperialism as a recurrent phenomenon in international relations with emphasis on the relations between advanced and emergent nations. Mr. Fliess.

730-739. PUBLIC ADMINISTRATION.

730. PROSEMINAR IN PUBLIC ADMINISTRATION.

731. TUTORIAL IN PUBLIC ADMINISTRATION.

732. DIRECTED STUDIES IN PUBLIC ADMINISTRATION.

733. PUBLIC ADMINISTRATION: ORGANIZATION.
Behavior within governmental bureaucracy, in terms of the interaction between the individual and organizational influences. Mr. Mainzer.

734. PUBLIC ADMINISTRATION: RESPONSIBILITY.
Problems of political responsibility of government bureaucracy within specific constitutional systems. Mr. Mainzer.

735. COMPARATIVE PUBLIC ADMINISTRATION.
Comparative analysis of the government administrative systems of the U.S., Britain, Canada, France, the U.S.S.R., and other selected countries. Mr. Kramer.

736. PUBLIC BUDGETING AND SYSTEMATIC ANALYSIS.

The theory and techniques of budgeting and systematic analysis and the political processes that relate these techniques to decision-making within the governmental organization. Mr. Kramer.

740-49. PUBLIC LAW.

740. PROSEMINAR IN PUBLIC LAW.

741. TUTORIAL IN PUBLIC LAW.

742. DIRECTED STUDIES IN PUBLIC LAW.

743. LAW AND THE POLITICAL PROCESS.
The interrelationships between law and politics, and the functions of law in organized societies. Mr. Alfange, Mr. Beth, Mr. Goldman.

744. THEORIES OF LAW AND JUDICIAL BEHAVIOR.
The theories of law, jurisprudence, and/or judicial behavior. Mr. Alfange, Mr. Beth, Mr. Goldman.

750-759. STATE AND LOCAL POLITICS.

750. PROSEMINAR IN STATE AND LOCAL POLITICS.

751. TUTORIAL IN STATE AND LOCAL POLITICS.

752. DIRECTED STUDIES IN STATE AND LOCAL POLITICS.

753. URBAN POLITICAL SYSTEMS.
Comparative analysis of relationships among socioeconomic, environmental, and political structures and processes, and public policy outcomes in cities. Research applications of contemporary concepts and theories. Mr. Booth, Mr. Coulter, Mr. Howards.

754. THEORY OF LOCAL GOVERNMENT.
Theories of local government; general uniformities in the governmental process. Mr. Booth, Mr. Coulter, Mr. Howards.

760-769. POLITICAL THEORY.

760. PROSEMINAR IN POLITICAL THEORY.

761. TUTORIAL IN POLITICAL THEORY.

762. DIRECTED STUDIES IN POLITICAL THEORY.

763. RECENT POLITICAL THEORY.
Contemporary theories about the possibilities and limits of operationalism, behavioralism, and the decision-making approach in political science. Mr. Oppenheim.

764. CHURCH AND STATE.
Relations between western and non-western religions and the state; analysis of the ideas and other forces underlying this relationship, especially since 1918. Mr. Lewy.

765. THE INDIVIDUAL AND THE STATE.
The problem of political obligation in political theory and in its historical and social contexts; the medieval right of resistance, the social contract, anarchism, resistance to totalitarianism, non-violent resistance, conscientious objection to war. Mr. Lewy.

766. PHILOSOPHICAL FOUNDATIONS OF
POLITICAL SCIENCE.

Critical examination of the principal contemporary views concerning the methods of gaining knowledge of political phenomena.
Mr. Connolly.

767. EMPIRICAL RESEARCH IN POLITICAL
BEHAVIOR.

Introduction to research techniques as applied to special problems in the field of political behavior. Emphasis on various approaches to the study of the individual voter, the American politician, interest groups and legislatures.
Mr. Fenton.

768. REVOLUTONS AND REVOLUTIONARY
MOVEMENTS.

The phenomenon of revolution in modern times; the theory and practice of revolution in Jacobinism, Marxism, anarchism, Leninism, syndicalism, fascism, Castroism.
Mr. Lewy.

770-779. AREA STUDIES.

771. TUTORIAL IN AREA STUDIES.

772. DIRECTED STUDIES IN AREA STUDIES.

773. POLITICS OF SOUTH ASIA.

Selected problems relating to the government and politics of India, Pakistan, and Ceylon.
Mr. Syed.

774. POLITICS OF EAST ASIA.

Selected problems relating to the politics of China, Japan, and other Asian countries.
Mr. Houn, Mr. Maki.

776. AFRICAN POLITICS.

Selected contemporary problems in African government and politics.
Mr. Feit.

777. LATIN AMERICAN POLITICS.

Comparative study of Latin American politics and government.
Mr. Kline, Mr. Wiarda.

778. EUROPEAN POLITICS.

Selected political cultures and systems in Europe.
Mr. Braunthal, Mr. King.

779. POLITICS AND FOREIGN POLICIES OF THE
MIDDLE EAST AND NORTH AFRICA.

The regional and international politics of the Middle East and North Africa, focusing on questions and problems that promote conflict or collaboration in the area.
Miss Meo.

800. MASTER'S THESIS.

Credit, 30.

900. DOCTORAL DISSERTATION.

Credit, 15.

COURSES OPEN TO BOTH GRADUATE AND
UNDERGRADUATE STUDENTS

501. ANCIENT AND MEDIEVAL POLITICAL
THOUGHT.

Development of political thought and its relation to cultural and institutional growth from the time of the Greeks to the end of the Middle Ages.
Mr. Connolly, Mr. King, Mr. Lewy, Mr. Oppenheim.

502. MODERN POLITICAL THOUGHT.

Development of political thought and its relation to cultural and institutional growth from the rise of the modern state to the present.
Mr. Connolly, Mr. King,
Mr. Lewy, Mr. Oppenheim, Mr. Syed.

503. PROBLEMS IN POLITICAL THOUGHT.

Some basic problems of political science, political ethics, and political philosophy through study of selected classical and modern political thinkers.
Mr. Connolly, Mr. Mileur, Mr. Oppenheim.

518. POLITICAL PARTIES AND ELECTIONS.

American political processes. Emphasis on parties, pressure groups and public opinion.

Mr. Coulter, Mr. Fenton, Mr. Gordon,
Mr. Mileur, Mr. Shanley, Mr. Sulzner.

519. STATE GOVERNMENT.

American state politics, organization, and functions. Emphasis on the role of the state in our federal system.

Mr. Booth, Mr. Coulter, Mr. Gere,
Mr. Howards, Mr. Shanley.

520. MUNICIPAL GOVERNMENT.

Survey of the structure and function of government in American municipalities.

Mr. Booth, Mr. Coulter, Mr. Gere,
Mr. Grady, Mr. Howards, Mr. Shanley.

522. MASSACHUSETTS POLITICS.

Analysis of the significant characteristics of Massachusetts politics as applied to political problems from an historical perspective with both a theoretical and practical base. Field work, readings, lectures, and discussions.
Mr. Friedman.

533. GOVERNMENT AND POLITICS OF THE
MIDDLE EAST.

A review of the dynamics of the traditional Islamic political system and of the transformation of that system under the impact of Western penetration of the Middle East. Contemporary Middle East politics with special reference to the politics of Israel, Syria, Lebanon and the UAR.
Miss Meo.

534. GOVERNMENT AND POLITICS OF
JAPAN (D).

Government and politics of modern Japan with emphasis on the post-1945 period; descriptive analysis of structure and function of government and political process.

Mr. Maki.

535. EAST CENTRAL EUROPE.

Survey of the major governments in the East Central European area with emphasis on the nature of Communist Party control. Governments include those of Czechoslovakia, East Germany, Hungary, Poland, Rumania, Yugoslavia, and others.
Mr. Ryavec, Mr. Vali.

536. GOVERNMENT AND POLITICS OF RUSSIA.

Development, organization, and functioning of the Communist Party; governmental organization and administrative process; terror as a system of power; organization for government control in industry and agriculture; Soviet foreign policy, its formation and execution.

Mr. Ryavec, Mr. Vali.

537. GOVERNMENT AND POLITICS OF CHINA.

An analysis of the genesis and dynamics of the Chinese Communist movement, the ideology and organization of the party and the government, and major domestic and foreign policies since 1949, with special reference to the Maoist attempts to reform man and society as well as to achieve modernization.
Mr. Houn.

538. GOVERNMENT AND POLITICS OF SOUTH
AND SOUTHEAST ASIA.

Comparative study of the institutions and dynamics of government and politics in South and Southeast Asia, especially India, Pakistan, Indonesia, and Malaysia, with reference to issues of political stability, economic development, and relations with the U.S. and other great powers.
Mr. Allen, Mr. Syed.

539. WEST EUROPEAN COMPARATIVE
POLITICS.

Analysis of the political cultures, institutions, systems, and processes of selected West European countries. Emphasis on social and economic factors relating to contemporary political issues.

Mr. Braunthal, Mr. Einhorn, Mr. King.

540. GOVERNMENT AND POLITICS OF
SOUTH AMERICA.

Comparative analysis of the interest groups, political parties, and government institutions of the South Amer-

ican countries. Emphasis on the background and political culture in which Latin American politics and government takes place. Mr. Kline, Mr. Wiarda.

541. GOVERNMENT AND POLITICS OF CENTRAL AMERICA AND THE CARIBBEAN.
Comparative analysis of the interest groups, political parties, and government institutions of the Central American and Caribbean countries. Emphasis on communism and the role of the U.S. Mr. Kline, Mr. Wiarda.

542. THE POLITICS OF SUB-SAHARAN AFRICA.
The organization and processes of African politics, centering on the general political problems facing contemporary African governments. Mr. Feit, Mr. Steeper.

543. COMPARATIVE AFRICAN GOVERNMENTS.
Comparative study of the political process in five African states. Mr. Feit, Mr. Steeper.

544. POLITICAL DEVELOPMENT AND MODERNIZATION.
Comparative analysis of political change and development in the emerging nations. Mr. Kramer, Mr. Maki, Mr. Syed, Mr. Wiarda.

545. POLITICS IN THE IBERIAN PENINSULA: THE POLITICAL SYSTEMS OF SPAIN AND PORTUGAL.
The unique aspects of the process of political development and/or decay) in Spain and Portugal. Emphasis on the heritage of these two nations as reflected in their New World colonies in the Americas and on the present-day pattern of politics in the Iberian peninsula. Prerequisites, Pol Sci 150 or 160-161 or permission of instructor. Mr. Wiarda.

548. GREAT BRITAIN AND THE COMMONWEALTH.
The practice of parliamentary government in Great Britain and the Commonwealth countries. Emphasis on development of the conception of the Commonwealth, the institutions through which the Commonwealth operates, and its contemporary world politics.

551. INTERNATIONAL RELATIONS.
The nation-state system and conceptions of national interest in modern world politics. Emphasis on forms and distribution of power, the making of foreign policy, and the adjusting of international conflict. Mr. Allen, Mr. Braunthal, Mr. Fliess, Mr. Steeper, Mr. Vali.

572. PUBLIC ADMINISTRATION.
Organization of bureaucracy, bureaucratic life, constitutional position, and political role of governmental bureaucracy. Mr. Kramer, Mr. Lederle, Mr. Mainzer, Mr. Reid.

573. PUBLIC PERSONNEL ADMINISTRATION.
The personnel function in bureaucracy; patronage and merit; career service and political executives; authority and informal organization; employee rights and collective action. Mr. Kramer, Mr. Lederle, Mr. Mainzer.

575. COMPARATIVE PUBLIC POLICY.
A comparative analysis of policy formation; the process of social and economic policy decision-making in selected industrial societies; the interaction of institutions, ideas, and power in decisions concerning social welfare, economic planning, and related policy areas. Mr. Einhorn.

576. POLITICAL THEORY, IDEOLOGY, AND PUBLIC POLICY.
The evaluation of social policy; a consideration of normative issues raised in controversies concerning social and economic policy in the light of the main traditions of Western political thought and the logical and ethical aspects of public choice. Mr. Eagan.

577. ARMED FORCES AND POLITICAL POLICY.
Comparative study of civilian-military relations in the Western and non-Western nations, concentrating both on regular and irregular armed forces. Mr. Feit.

590. CONSTITUTIONAL LAW.
The United States Constitution as interpreted by decisions of the Supreme Court. Mr. Alfange, Mr. Beth, Mr. Goldman.

591. CIVIL LIBERTIES.
The development in American Constitutional law of the concept of civil liberty, including the fields of free speech and religion, fair trial, and race discrimination. The function of courts in safeguarding these liberties. Mr. Alfange, Mr. Beth, Mr. Goldman.

592. POLITICS, LAW, AND JUDICIAL BEHAVIOR.
Law as the political and social means of adjusting community needs and desires to governmental policy. Judicial behavior within the context of the political system. Mr. Alfange, Mr. Beth, Mr. Goldman.

603. AMERICAN POLITICAL THOUGHT.
The development of American political thought from Colonial times to the present. Mr. Gere, Mr. King, Mr. Mileur, Mr. Syed.

606. COMMUNIST POLITICAL THOUGHT.
The philosophic and religious origins of Communism in Western and Eastern Europe. Analysis of the classics from Marx to Khrushchev. Mr. Fliess.

621. THE PRESIDENCY IN AMERICAN GOVERNMENT.
The growth of the executive in the United States government. Varying conceptions of the presidential office. Constitutional and political aspects of the office in legislation, administration, and conduct of foreign and military affairs. The president as party leader. Mr. Bach, Mr. Gordon, Mr. Kramer, Mr. Sulzner.

622. THE LEGISLATIVE PROCESS.
The role of the legislature in national and state government. The functions of legislatures; legislative procedures; the role of political parties and pressure groups in the legislative process. Mr. Bach, Mr. Gordon, Mr. Sulzner.

623. PUBLIC OPINION IN POLITICS.
Opinion and communication as aspects of the political process. Emphasis on communication through mass media. The relations between mass attitudes and communication and political institutions and the formation of public policy. Mr. Fenton.

624. METROPOLITAN POLITICS.
Problems of metropolitan areas; actual and possible political approaches to their solution. Emphasis on the role of parties, the development of political leadership, existing political institutions, and pressure group activity. Prerequisite, Pol Sci 218 or permission of instructor. Mr. Booth, Mr. Coulter, Mr. Howards, Mr. Shanley.

625. BLACK POLITICS.
Theoretical and historical analysis of the relationship of Black people to the American political system. The development of Black ideologies, political organizations, and strategies, and on alternative forms of participation in the American political system. Mr. Booth, Mr. Sulzner.

655. AMERICAN FOREIGN POLICY.
Constitutional, political, and administrative considerations which influence the formulation and execution of American foreign policy. Emphasis on current issues. Mr. Allen, Mr. Braunthal, Mr. Steeper.

656. INTERNATIONAL LAW.
The origin, character, and function of international law. Mr. Braunthal, Mr. Fliess, Mr. Steeper, Mr. Vali.

657. INTERNATIONAL ORGANIZATION.

International organization in the 20th century. Emphasis on the United Nations and regional organization.

Mr. Braunthal, Mr. Fliess, Mr. Steeper, Mr. Vali.

659. WESTERN EUROPE AND THE ATLANTIC COMMUNITY.

An analysis of the emerging institutional patterns of the West European and Atlantic communities. The major political, military, and economic regional organizations.

Mr. Braunthal.

660. SOVIET FOREIGN POLICY.

An analysis of continuity and change in Soviet perceptions, goals, methods, and priorities in foreign policy. Emphasis on the period since World War II.

Mr. Ryavec.

674. ADMINISTRATIVE LAW.

Governmental activities in the regulation of industry, agriculture, and labor. Emphasis on the legal framework within which these activities operate.

Mr. Lederle.

Polymer Science and Engineering

GRADUATE FACULTY

ROGER S. PORTER, *Head of the Program in Polymer Science and Engineering and Professor, B.S., University of California at Los Angeles, 1950; Ph.D., University of Washington, Seattle, 1956.*

JAMES C. W. CHEN, *Professor of Chemistry, B.S., St. John's, 1949; B.A., Wayland College, 1950; M.S., Kentucky, 1951; Ph.D., Wisconsin, 1954.*

FRANK E. KARASZ, *Professor, B.S., Imperial College, University of London, 1954; Ph.D., University of Washington, Seattle, 1957.*

ROBERT L. LAURENCE, *Associate Professor of Chemical Engineering.*

ROBERT W. LENZ, *Professor of Chemical Engineering.*

WILLIAM J. MACKNIGHT, *Associate Professor of Chemistry.*

STANLEY MIDDLEMAN, *Professor of Chemical Engineering.*

SEYMOUR NEWMAN, *Adjunct Associate Professor, B.S., College of the City of New York, 1942; M.A., Columbia, 1947; Ph.D., Polytechnic Institute of Brooklyn, 1949.*

FRASER P. PRICE, *Professor, B.A., Columbia, 1938; Ph.D., 1941.*

RICHARD S. STEIN, *Commonwealth Professor of Chemistry and Director of the Polymer Research Institute.*

OTTO VOGL, *Professor, B.S., University of Vienna, 1945; Ph.D., 1950.*

THE DOCTOR OF PHILOSOPHY DEGREE PROGRAM

Admission Requirements:

1. A B.S. or B.A. in chemistry, engineering, or physics.
2. Undergraduate work in two of the following areas:

- a. Organic chemistry.
- b. Physical chemistry.
- c. Thermodynamics.
- d. Electronics.
- e. Unit operations.
- f. Mechanics of materials.

Prescribed Program:

1. Undergraduate courses in areas under 2, above, where there have not been previous studies.
2. Core and basic requirements:

	Credits
501. INTRODUCTION TO POLYMER SCIENCE.	3
502. POLYMER SCIENCE LABORATORY.	3
790. ORGANIC POLYMERIZATION REACTIONS.	3
791. PHYSICAL CHEMISTRY OF HIGH POLYMERS.	3
792. RHEOLOGY.	3
793. POLYMER PROCESSING.	3
720-769. POLYMER SCIENCE AND ENGINEERING ELECTIVES.	2-3 ea.
780-3. POLYMER SCIENCE AND ENGINEERING SEMINAR.	1 ea. sem.
786. RESEARCH PROPOSAL.	1 ea. sem.

Also, course electives (10-20 credits), language and comprehensive examinations as approved by the Polymer Science and Engineering Committee and as required by the Graduate School.

900. DISSERTATION.

THE MASTER OF SCIENCE DEGREE PROGRAM

Requirements for admission are the same as those for entry into Ph.D. Program.

Suggested Programs

With thesis:

	Credits
501. INTRODUCTION TO POLYMER SCIENCE.	3
502. POLYMER SCIENCE LABORATORY.	3
790. ORGANIC POLYMERIZATION REACTIONS.	3
791. PHYSICAL CHEMISTRY OF HIGH POLYMERS.	3
792. RHEOLOGY.	3
793. POLYMER PROCESSING.	3
720-769. POLYMER SCIENCE AND ENGINEERING ELECTIVES.	2-3 ea.
780-3. POLYMER SCIENCE AND ENGINEERING SEMINAR.	1 ea. sem.
800. MASTER'S THESIS.	10

Without thesis:

	Credits
501. INTRODUCTION TO POLYMER SCIENCE.	3

502. POLYMER SCIENCE LABORATORY.	3
790. ORGANIC POLYMERIZATION REACTIONS.	3
791. PHYSICAL CHEMISTRY OF HIGH POLYMERS.	3
792. RHEOLOGY.	3
793. POLYMER PROCESSING.	3
720-769. POLYMER SCIENCE AND ENGINEERING ELECTIVES.	2-3 ea.
770. INTRODUCTION TO RESEARCH.	1-3
780-3. POLYMER SCIENCE AND ENGINEERING SEMINAR.	1 ea. sem.

Also, course electives (7 credits) selected from suggested list for the Ph.D. program (brochure available from the Department upon request).

Both the master's and doctor's programs in Polymer Science and Engineering are interdisciplinary in nature and are designed to provide a broad and fundamental education in polymers. Entering students will normally have a bachelor's or master's degree in chemistry, engineering, or physics. Flexibility in the first year's curriculum allows for basic work in fields other than the student's undergraduate major and for prerequisites for advanced work in the PSE program. There is a basic core of courses within the PSE program, with sufficient electives to provide options for students with either a chemistry-physics emphasis or an engineering emphasis. The program requires an intermediate-level reading knowledge of one foreign language for all doctoral candidates.

ALL COURSES CARRY 3 CREDITS UNLESS OTHERWISE SPECIFIED

COURSES OPEN TO GRADUATE STUDENTS ONLY

(For either major or minor credit)

720-769. POLYMER SCIENCE AND ENGINEERING ELECTIVES.

Lecture and seminar courses in which advanced aspects of some area pertinent to polymer science and engineering are intensively explored. The course rotates among staff members in the program and generally is in a field of particular interest to the staff members concerned. Two or three class hours.

Prerequisites, PSE 501 and permission of instructor.

Credit, 2 or 3 each course.

721. MICROSCOPY AND MORPHOLOGY OF POLYMERS.

The use of the light and electron microscope. Phase contrast, interference methods, selected area diffraction, scattering techniques, and replication and decoration methods for the study and characterization of the morphology of polymeric structures.

Two class hours, four laboratory hours per week.

Prerequisites, PSE 501, general physics, optics desirable. Mr. Price.

770. INTRODUCTION TO RESEARCH.

Independent student research on a specific project in polymer science or engineering, selected to teach research methods and techniques and to acquire new knowledge. Requirement, approval of the department head.

Credit, 1-3.

780-783. POLYMER SCIENCE AND ENGINEERING SEMINAR.

Students, staff members, and visitors present seminars dealing with current research and literature reviews in

polymer science and engineering and in related areas of materials science.

About two seminar hours per week.

Credit, 1 each semester.

786. RESEARCH PROPOSAL.

Students write and defend a proposal for an experimental investigation of a research problem not directly related to their thesis topic. The project selected requires approval of the thesis committee, and involves primarily library research.

Credit, 1 each semester.

790. ORGANIC POLYMERIZATION REACTIONS.

Mechanisms, kinetics, and thermodynamics of principal types of polymerization reactions.

Prerequisites, PSE 501; Chem 571 or equivalent.

Mr. Vogl.

791. PHYSICAL CHEMISTRY OF HIGH POLYMERS.

Structure of solid polymers, determination of molecular weights, sizes and shapes, mechanical properties of solid polymers, colligative properties of polymer solutions, polyelectrolytes, and physical chemistry of proteins.

Prerequisite, Chem 785 or equivalent.

792. RHEOLOGY.

Definition and measurement of rheological properties; continuum mechanics and constitutive equations; molecular theories of polymer deformation; correlation and interrelation of material functions. Relation of the various approaches taken in describing the viscous and viscoelastic properties of polymers, evaluation of these approaches; the role of modern rheology in the characterization and processing of polymers.

Mr. Middleman, Mr. Porter.

793. POLYMER PROCESSING.

Application of principles of chemical engineering to analysis of polymer processes such as extrusion, roll coating, mixing, etc. Applied fluid dynamics; some attention to heat and mass transfer.

Prerequisite, PSE 792.

Mr. Middleman, Mr. Porter.

800. MASTER'S THESIS.

Credit, 6-10.

900. DOCTORAL DISSERTATION.

Credit, 30.

COURSE OPEN TO BOTH GRADUATE AND UNDERGRADUATE STUDENTS

(For either major or minor credit)

501. INTRODUCTION TO POLYMER SCIENCE.

Physical and organic chemistry of polymers for persons with basic training in chemistry, physics, or engineering. A survey of preparative methods of polymers, means of preparation of polymers of controlled structure, the physical chemistry of polymer molecules in solution, liquid and solid phases, thermodynamics and statistics of polymers, methods of characterization, mechanical properties of polymeric solids and fundamentals of industrial preparative and fabrication techniques.

Prerequisite, one year of physical chemistry and one semester of organic chemistry or permission of instructor.

RELATED COURSES

Ch E 670. APPLIED POLYMER SCIENCE.

Biochem 728. PROTEIN PHYSICAL CHEMISTRY.

M A E 650. X-RAY DIFFRACTION.

M A E 709. MECHANICAL PROPERTIES OF MATERIALS.

M A E 881. SELECTED TOPICS IN MATERIALS.

Ch E 711-712. TRANSPORT PHENOMENA.

Psychology

GRADUATE FACULTY

RICHARD T. LOUTTIT, *Head of the Department of Psychology and Professor*, B.A., De Pauw University, 1954; M.A., University of Michigan, 1959; Ph.D., 1961.

ERNEST DZENDOLET, *Director of Graduate Studies in Psychology and Professor*, B.S., California Institute of Technology, 1951; M.S., Brown, 1957; Ph.D., 1959.

ICEK AJZEN, *Assistant Professor*, B.A., Hebrew University of Jerusalem, 1967; M.A., University of Illinois, 1967; Ph.D., 1969.

DANIEL ANDERSON, *Assistant Professor*, B.S., University of Wisconsin, 1966; M.A., Brown University, 1966; Ph.D., 1970.

DEE G. APPELY, *Professor*, B.A., University of Denver, 1945; M.A., University of Michigan, 1949; Ph.D., 1952.

MORTIMER H. APPELY, *Dean of the Graduate School and Professor*, B.S., City College of New York, 1942; M.A., University of Denver, 1946; Ph.D., University of Michigan, 1950.

MICHAEL A. ARBIB, *Professor of Computer and Information Science and Psychology*.

JAMES R. AVERILL, *Associate Professor*, B.A., San Jose State College, 1959; Ph.D., University of California, Los Angeles, 1966.

JOHN J. B. AYRES, *Assistant Professor*, B.A., William and Mary, 1961; M.A., University of Kentucky, 1963; Ph.D., 1965.

SAUL BALAGURA, *Associate Professor*, M.D., Facultad de Medicina, Universidad del Valle, 1964; M.A., Princeton University, 1966; Ph.D., 1967.

JOAN P. BEAN, *Assistant Professor*, B.A., San Jose State College, 1966; M.A., 1968; Ph.D., University of California, Berkeley, 1971.

SEYMOUR M. BERGER, *Professor*, B.A., Oklahoma A and M College, 1949; M.A., Columbia, 1950; Ph.D., Cornell University, 1959.

RICHARD S. BOGARTZ, *Professor*, B.A., University of California, Los Angeles, 1957; Ph.D., 1961.

NEIL CARLSON, *Assistant Professor*, B.A., University of Illinois, 1964; M.A., 1966; Ph.D., 1966.

SHELDON CASHDAN, *Associate Professor*, B.S., City College of New York, 1958; M.A., University of North Carolina, 1963; Ph.D., 1965.

JAMES I. CHUMBLEY, *Assistant Professor*, B.A., Drake, 1960; M.S., Indiana University, 1963; Ph.D., 1967.

CHARLES E. CLIFTON, *Associate Head of the Department of Psychology and Associate Professor*, B.A., Stanford University, 1960; Ph.D., University of Minnesota, 1964.

RACHEL K. CLIFTON, *Assistant Professor*, B.A., Berea College, 1959; M.A., University of Minnesota, 1960; Ph.D., 1963.

MARVIN DAEHLER, *Assistant Professor*, B.A., University of Illinois, 1964; M.A., University of Minnesota, 1966; Ph.D., 1968.

JOHN T. DANIELSON, *Assistant Professor*, B.S., Rensselaer Polytechnic Institute, 1964; M.S., Brown, 1966; Ph.D., 1969.

JOHN W. DONAHOE, *Professor*, B.A., University of Kentucky, 1954; M.S., 1956; Ph.D., 1958.

J. WILLIAM DORRIS, *Assistant Professor*, B.A., University of California, Berkeley, 1966; M.A., University of California, Los Angeles, 1967; Ph.D., 1970.

WILLIAM J. DUFFY, *Associate Professor of Industrial Engineering and Psychology*.

ALICE H. EAGLY, *Associate Professor*, B.A., Radcliffe, 1960; M.A., University of Michigan, 1963; Ph.D., 1965.

WILLIAM EICHELMAN, *Assistant Professor*, B.A., University of Hartford, 1965; M.S., University of Oregon, 1968; Ph.D., 1970.

SEYMOUR EPSTEIN, *Professor*, B.A., Brooklyn College, 1948; M.A., University of Wisconsin, 1951; Ph.D., 1953.

ROBERT S. FELDMAN, *Professor*, B.S., University of Michigan, 1943; M.A., 1944; Ph.D., 1951.

KATHERINE V. FITE, *Assistant Professor*, B.S., Florida State University, 1963; M.S., Brown University, 1967; Ph.D., 1969.

HOWARD CADLIN, *Assistant Professor*, B.A., Queens College, 1962; Ph.D., University of Michigan, 1966.

STUART GOLANN, *Associate Professor*, B.A., Queens College, 1957; M.A., University of North Carolina, 1959; Ph.D., 1961.

RONALD K. HAMBLETON, *Assistant Professor of Education and Psychology*.

MORTON G. HARMATZ, *Associate Professor*, B.A., Ohio State University, 1960; M.A., University of Washington, 1962; Ph.D., 1963.

HAROLD JARMON, *Associate Professor*, B.A., New York University, 1955; M.A., University of Kansas, 1959; Ph.D., 1962.

ALAN C. KAMIL, *Assistant Professor*, B.A., Hofstra College, 1963; M.S., University of Wisconsin, 1966; Ph.D., 1967.

SOLIS L. KATES, *Professor*, B.S., City College of New York, 1935; M.S., 1937; Ph.D., Columbia, 1948.

EDWARD E. KRIECKHAUS, *Associate Professor*, B.A., Williams College, 1954; Ph.D., University of Illinois, 1962.

GEORGE LEVINGER, *Professor*, B.A., Columbia, 1946; M.A., University of California, Berkeley, 1951; Ph.D., University of Michigan, 1955.

ALAN LIEBERMAN, *Assistant Professor*, B.S., Brooklyn College, 1953; M.A., University of Connecticut, 1955; Ph.D., 1960.

JOHN W. MOORE, *Professor*, B.A., Lawrence College, 1958; Ph.D., Indiana University, 1962.

STANLEY M. MOSS, *Associate Professor*, B.A., Ohio State, 1957; M.A., 1958; Ph.D., 1962.

JEROME L. MYERS, *Professor*, B.A., Syracuse, 1953; M.A., Wisconsin, 1955; Ph.D., 1957.

NANCY A. MYERS, *Associate Professor*, B.A., Mount Holyoke, 1952; M.A., Wisconsin, 1954; Ph.D., 1957.

JOHN GREGORY OLLEY, *Assistant Professor*, A.B., College of William and Mary, 1966; M.A., Wake Forest University, 1968; Ph.D., George Peabody College, 1972.

ALEXANDER POLLATSEK, *Assistant Professor*, B.S., University of Michigan, 1961; M.A., Harvard University, 1963; M.S., University of Michigan, 1964; M.A., 1965; Ph.D., 1969.

HAROLD RAUSH, *Professor*, B.A., University of Michigan, 1941; M.A., University of Michigan, 1942; Ph.D., Stanford University, 1950.

STEPHEN REISMAN, *Assistant Professor*, B.A., City University of New York, 1966; M.A., University of North Carolina, 1969; Ph.D., 1970.

JAMES M. ROYER, *Assistant Professor*, B.A., Chico State College, 1967; M.A., University of Illinois, 1969; Ph.D., 1970.

HARRY SCHUMER, *Associate Professor*, B.S., Ohio State, 1954; M.A., 1956; Ph.D., 1961.

NORMAN SIMONSON, *Associate Professor*, B.A., University of Rochester, 1960; Ph.D., Pennsylvania State University, 1968.

J. ALFRED SOUTHWORTH, *Professor*, B.S., U. S. Naval Academy, 1943; M.A., Harvard, 1955; Ph.D., 1956.

ERVIN STAUB, *Associate Professor*, B.A., University of Minnesota, 1962; Ph.D., Stanford University, 1965.

IVAN STEINER, *Professor*, B.A., Central Michigan College, 1941; M.A., University of Michigan, 1948; Ph.D., 1952.

HARIHARAN SWAMINATHAN, *Assistant Professor of Education and Psychology*.

DAVID M. TODD, *Assistant Professor*, B.A., Alma College, 1965; Ph.D., University of Michigan, 1971.

GILBERT C. TOLHURST, *Professor of Speech and Psychology*.

BARBARA F. TURNER, *Assistant Professor of Human Development and Psychology*.

CASTELLANO B. TURNER, *Assistant Professor*, B.A., DePaul University, 1957; M.A., 1963; University of Chicago, 1966.

GEORGE N. WADE, *Assistant Professor*, B.S., Pennsylvania State University, 1967; Ph.D., University of California, Berkeley, 1970.

NORMAN WATT, *Associate Professor*, B.A., Northwestern University, 1957; M.A., Ohio State University, 1960; Ph.D., 1962.

ARNOLD WELL, *Assistant Professor*, B.S., McGill University, 1961; M.S., University of Alberta, 1963; M.A., University of Oregon, 1966; Ph.D., 1969.

ROBERT H. WILLOUGHBY, *Assistant Professor*, B.A., Gettysburg College, 1960; M.S., Pittsburgh, 1962; Ph.D., Minnesota, 1967.

PATRICIA A. WISOCKI, *Assistant Professor*, B.A., Marygrove College, 1965; Boston College, 1967; Ph.D., Boston College, 1971.

VISITING GRADUATE FACULTY

WOLFGANG STROEBE, *Associate Professor*, D.I.P., University of Tuebingen, 1964; Ph.D., University of Muenster, 1966; Ph.D., University of London, 1968.

UNIVERSITY OF MASSACHUSETTS

The graduate program in psychology is oriented toward the Doctor of Philosophy degree, although students entering with a bachelor's degree are required to obtain a Master of Science degree en route to the Ph.D. Areas of concentration leading to the Ph.D. are: biopsychology (including animal and comparative learning, physiological, and sensory processes), child, clinical (including child clinical), cognitive processes, educational, personality, and social. However, a student is not necessarily limited to the above areas. He may develop a program within any of the fields of expertise represented within the faculty, by requesting approval from the Director of Graduate Studies.

Students must satisfy the general requirements of the Graduate School for the degree. They must also complete the course requirements of their area of specialization. A list of these requirements is supplied by the Department on request. The doctoral program provides practicum courses in each of the applied specialization areas. Neighboring institutions and agencies available for such field work include Belchertown State School, Clarke School for the Deaf, Department of Psychology Psychological Services Center, Holyoke Mental Health Clinic, Monson State Hospital, Northampton State Hospital, Northampton V. A. Hospital, Springfield Child Guidance Clinic, Springfield V. A. Mental Hygiene Clinic, University Nursery School, Worcester V. A. Mental Hygiene Clinic, and Worcester Youth Guidance Center.

There is no general foreign-language requirement for degree qualification in psychology. However, students may be expected to demonstrate satisfactory levels of competence in one or more languages other than English in cases where a significant body of relevant literature exists in a foreign language and is not available in suitable translation. In addition, all graduate students in psychology are expected to achieve at least minimal competence with computer programming.

All students must complete Psychology 545, and submit a master's thesis, Psychology 800, to qualify for the Master of Science degree in Psychology, in addition to meeting the requirements of the Graduate School. A final oral examination given by the thesis committee and the Department is required. Credits taken to satisfy the requirements for the master's degree can be applied to the total number of credits required for the doctorate.

Students applying for admission to the graduate psychology program, in addition to meeting the requirements of the Graduate School, should have taken an introductory course and 18 additional undergraduate credits in psychology, including a course in laboratory experimental psychology, or the equivalent, and a course in statistics. In case the student has not taken this number of credits or lacks these courses, he may be allowed to make up the deficiencies in undergraduate courses. In exceptional cases, students with entrance deficiencies may, at the end of one semester's study, petition the department to waive remaining undergraduate deficiencies.

All students applying for admission to the graduate program must submit their scores on the Graduate Record Examination and on the Miller Analogies Test. Further information on Departmental and area requirements may be obtained on request from the Department.

ALL COURSES CARRY 3 CREDITS UNLESS OTHERWISE SPECIFIED

COURSES OPEN TO GRADUATE STUDENTS ONLY

(For either major or minor credit)

700. PROBLEM IN PSYCHOLOGY.

A research project which may be taken in lieu of the master's thesis or by doctoral students as minor research. *Credit, 3 each semester; maximum credit, 12.*

706. DEVELOPMENTAL PSYCHOLOGY.

Selected issues, both historical and contemporary, in developmental psychology.

711. SENSORY PROCESSES I.

Auditory, cutaneous senses, and labyrinthine senses; the fundamental data with their implications concerning functioning of these systems.

Prerequisites, Psych 210 or 6 credits of advanced psychology or equivalent.

712. SENSORY PROCESSES II.

Visual, gustatory, and olfactory senses; the fundamental data with their implications concerning functioning of these systems.

Prerequisites, Psych 210 or 711 or 6 credits of advanced psychology or equivalent.

715. PERCEPTION.

Primarily vision and audition. Stress on perceptual processes, as opposed to sensory processes. The perception of form, space, depth; perceptual development and learning, etc.

Prerequisite, Psych 510 or equivalent.

720. LEARNING.

Basic phenomena and current research in animal and human learning.

721. CONDITIONING.

The basic laws of classical conditioning. Topics include the physiological bases of conditioning and related phenomena, the relationship of conditioning to more complex behavior, and relevant research techniques for animal and human experimentation. Lectures and laboratories.

723. ANIMAL LEARNING.

The implication of the basic laws of learning for explaining complex aspects of animal learning. Examples or topics may include application of classical conditioning models to instrumental situations, aversive control, discrimination learning, and primate learning.

725. HUMAN INFORMATION PROCESSING I.

Basic processes in human cognition and performance. Topics include attention, judgment, choice, short-term memory, and long-term memory.

Prerequisite, Psych 720 or permission of instructor.

726. HUMAN INFORMATION PROCESSING II.

Complex aspects of human cognition and performance. Topics include sequential behavior, concept formation, thinking, and psycholinguistics.

Prerequisite Psych 725 or permission of instructor.

731. EMOTION AND MOTIVATION.

The nature, determinants, and interrelationships of emotion and motivation; techniques involved in investigating these phenomena. Lectures and laboratories.

735. SYSTEMATIC PSYCHOLOGY.

The general structure of psychological theory and an historical and comparative consideration of the backgrounds, viewpoints on scientific methodology, research interests and techniques, and the component variables,

hypotheses, and laws of structural, Gestalt, functional, and behavioristic movements.

741. CORRELATIONAL TECHNIQUES.

Reasoning and assumptions underlying correlation analyses; inference; introduction to multivariate techniques; partial correlation; multiple correlation and regression, introduction to factor analysis.

Prerequisite, Psych 545, previously or concurrently, or permission of instructor.

742. PSYCHOLOGICAL SCALING.

Theories underlying measurement and scaling in psychology and the social sciences; models of judgment and choice; models of psychological similarity; models of attitudes and abilities; a comparison of unidimensional and multidimensional approaches. Emphasis on relating models to real problems.

Prerequisite, Psych 545, previously or concurrently, or permission of instructor.

744. FACTOR ANALYSIS.

Theory and methods of factor analysis in psychological research. Lectures and laboratory exercises.

Prerequisite, Psych 741 or equivalent.

745. ADVANCED APPLIED STATISTICS.

Various experimental designs, the assumptions underlying their use, and the appropriate statistical analysis; orthogonal and randomized designs, trend analysis, non-parametric techniques, and multivariate analysis.

Prerequisite, Psych 545 or equivalent.

746. QUANTITATIVE METHODS IN PSYCHOLOGY.

Mathematical descriptions of psychophysical and time-dependent data; parameter estimation; stochastic processes.

Prerequisites, Psych 545 and Math 123 or equivalent.

750. PHYSIOLOGICAL PSYCHOLOGY.

An intensive overview of the field. Topics include an introduction to neuroanatomy, techniques used in investigations of brain function, the physiological bases of emotion, motivation, reward and punishment, species-typical behavior, learning, and memory.

751. ADVANCED PHYSIOLOGICAL PSYCHOLOGY.

In-depth analysis of modern concepts in the study of the physiological and biochemical bases of behavior.

Prerequisite, permission of instructor.

752. THE NEUROANATOMICAL BASIS OF BEHAVIOR.

Structure and function of the mammalian nervous system as they relate to sensory-motor and motivational systems.

Prerequisite, Psych 550 or equivalent, or permission of instructor.

753. PSYCHOPHARMACOLOGY.

The mechanisms of drug behavior interactions. Topics are: neuronal ultrastructure, basic neurochemistry and neurophysiology, synaptic transmission, drugs that affect mood and behavior, chemical theories of mental disease, clinical and experimental psychopharmacology, drug dependence and addiction.

Prerequisite, Psych 550 or 552 or equivalent.

760. THEORIES OF CHILD DEVELOPMENT.

The more relevant theories of child development, specifically those which have served as the impetus for experimental research with children. Theoretical analysis of the personality; social and cognitive development of children.

762. LEARNING AND MEMORY PROCESSES IN CHILDREN.

Theoretical and experimental approaches to topics in learning and memory.
Two class hours, one 2-hour laboratory period.
Prerequisite, Psych 721 or 262 or permission of instructor.

763. COGNITIVE PROCESSES IN CHILDREN.

Piagetian, behavioristic, and information-processing approaches to research in conceptual development.
Two class hours, one 2-hour laboratory period.
Prerequisite, Psych 721 or 262 or permission of instructor.

764. PERCEPTUAL DEVELOPMENT IN CHILDREN.

An introduction to theories of perceptual development, consideration of sensory and perceptual capacities of the infant, and analysis of developmental changes in perception in the infant and older children.

766. PERSONALITY AND SOCIAL DEVELOPMENT IN CHILDREN.

Review and analysis of the literature on personality development and the socialization process in children.
Prerequisites, Psych 262, 270, or equivalents.

775. THE PSYCHOLOGY OF EXCEPTIONAL CHILDREN.

The etiology, diagnosis, and treatment of exceptional children, with emphasis on intellectual, social, physical, and sensory deviation.
Prerequisites, Psych 262, 325, or permission of instructor.

777. DIAGNOSIS AND TREATMENT OF BEHAVIOR DISORDERS IN CHILDREN.

The diagnosis and treatment of psychological maladjustments in infancy and childhood; treatment procedures, resources, and methods used in dealing with behavior and personality problems. Lectures, discussions, practicum sessions.
Prerequisites, Psych 325, 262 or 762, and 833.

780. ADVANCED SOCIAL PSYCHOLOGY.

An overview of theory and experimental research in social psychology. Topics include social perception, attitude structure and change, dyadic interaction, and group processes.

781. ATTITUDES.

Theory, method, and data concerned with the nature and structure of attitudes and opinions, the formation of attitudes, attitude change in response to communication and interpersonal influence.
Prerequisite, Psych 780.

782. SOCIAL JUDGMENT AND INTERPERSONAL PERCEPTION.

The influence of culture, values, needs, and attitudes on perceptual judgments; judgmental and inferential processes about persons and interpersonal behavior.
Prerequisites, Psych 780 and 710, permission of instructor.

783. SOCIAL LEARNING.

Concentration on theories of social learning, particularly those concerned with the analysis of the effectiveness of social reinforcement and observational learning.
Prerequisite, Psych 720 or equivalent.

784. GROUP DYNAMICS.

Interpersonal and group processes; attraction, influence, group structure, communication, cooperation, leadership, group performance. Focus on theory, experimentation, and special problems of the field.
Prerequisite, Psych 780.

793. ADVANCED EDUCATIONAL PSYCHOLOGY.

The psychological principles and concepts of development learning as related to educative process and their application to teaching. Primarily intended for graduate students in Education including MAT candidates.
Prerequisite, Psych 301 or equivalent, or permission of instructor.

794. SOCIAL PSYCHOLOGY IN THE SCHOOLS.

Review and analysis of the social psychological literature as it pertains to school and educational issues. Emphasis on social interaction in the classroom.
Prerequisite, Psych 280 or equivalent, or permission of instructor.

795. PSYCHOLOGY OF CLASSROOM LEARNING.

Review and analysis of the findings of psychology that pertain to introduction. Emphasis on the practical control of learning activities especially as seen in the classroom.
Prerequisite, Psych 280 or equivalent, or permission of instructor.

821. PERSONALITY.

The basic concepts and principles in the study of personality, including theoretical research issues. Emphasis on recent research in specific areas of personality.

830. CLINICAL I.

Roles and functions of clinicians in various settings, current professional issues. Introduction to assessment as related to alternative view of abnormality and personality. Lecture and laboratory. *Credit, 6.*

831. CLINICAL II.

Logic and process of assessment and description of behavior. Basic models and descriptive systems in conjunction with skill development in the use of exemplary techniques including objective and projective tests and naturalistic observation. Relation of models and techniques to models of abnormal behavior and personality. Lecture and laboratory.
Prerequisite, Psych 830. *Credit, 6.*

833. CLINICAL III.

Problem-formulating and problem-solving within various clinical situations and clinical models. Integration and communication of findings from psychological assessment. Lecture and laboratory.
Prerequisite, permission of instructor. *Credit, 6.*

834. OBJECTIVE PERSONALITY, INTEREST, AND APTITUDE ASSESSMENT.

Review and analysis of the psychological literature pertaining to structured personality, interest, and aptitude tests.
Two class hours, one 2-hour laboratory period.
Prerequisite, Psych 832 or equivalent.

835. CLINICAL IV.

The theory of the individual techniques of psychotherapy and demonstration of these techniques through video and other tapes, and role-playing. Psychotherapeutic techniques considered may include psychoanalytic, ego psychoanalytic, behavior therapy, operant conditioning, socially oriented, rational-emotive, existential-humanistic, and client-centered.
Three lecture hours and two hours of laboratory.
Prerequisite, Psych 833. *Credit, 4.*

836. CLINICAL V.

Theoretical and research approaches to group and family therapies. Laboratory provides practicum experiences in these techniques.
Three lecture hours and three hours of laboratory.
Prerequisite, Psych 835. *Credit, 4.*

840. SEMINAR IN CLINICAL PRACTICE.

A topic concerned with the practice of clinical psychology. *Credit, 2.*

841. SEMINAR IN PERSONALITY.

A topic concerned with the area of personality. *Credit, 2.*

842. SEMINAR IN CLINICAL RESEARCH.

A topic concerned with research in clinical psychology. *Credit, 2.*

843. SEMINAR IN CLINICAL SPECIALTY.

A topic concerned with a specialty area within clinical psychology. *Credit, 2.*

852. SEMINAR IN COGNITIVE PROCESSES.

Advanced consideration of selected topics in human cognition and performance. Topics chosen from attention, judgment, choice, memory, sequential behavior, concept formation, and psycholinguistics.

May be repeated for credit. *Credit, 1-9.*

853. SEMINAR IN QUANTITATIVE THEORIES OF BEHAVIOR.

Examination and evaluation of quantitative theories of selected behavioral phenomena. Topics selected from choice, detection and recognition, judgment, memory, learning, and concept-formation.

Prerequisite, Psych 746 or permission of instructor. May be repeated for credit. *Credit, 1-9.*

860. BASIC CONCEPTS IN COUNSELING PSYCHOLOGY.

Introductory review and analysis of the psychological literature related to the practice, research, and training functions in counseling psychology.

Prerequisite, 18 credits of psychology or permission of instructor.

865. COUNSELING THEORIES AND TECHNIQUES.

Detailed consideration of current theories and techniques employed in counseling psychology.

Prerequisites, Psych 270, 311, or permission of instructor.

866. THE PSYCHOLOGY OF VOCATIONAL DEVELOPMENT.

Review and analysis of the psychological literature concerning the psychological basis for vocational choice.

Prerequisite, Psych 834 or equivalent.

868. GROUP COUNSELING AND PSYCHOTHERAPY.

Review and analysis of the psychological literature in conjunction with experience in multiple counseling and therapeutic processes.

Two class hours, one 2-hour laboratory period.

Prerequisite, Psych 835 or 865 or equivalent.

871 (I), 872 (II). PRACTICUM.

Practice in the application of psychological techniques to clinical settings and counseling; and practice in teaching in any area of psychology. Either semester may be elected independently.

Taught with the staffs of cooperating institutions and agencies. *Credit, 3-12.*

873 (I), 874 (II). TEACHING PRACTICUM IN PSYCHOLOGY.

Required of all doctoral candidates. Experience in procedures, leading discussion groups and teaching labs. Close supervision by faculty members. Students meet once a week to discuss problems in teaching.

Credit, 3-12.

891 (I), 892 (II). SEMINAR.

Selected topics of current significance in psychology. Research studies analyzed and theoretical advances explored. Either semester may be elected independently. Both may be taken only with a change in topic.

Prerequisite, permission of instructor.

Credit, 2 each semester; maximum credit, 6.

895 (I), 896 (II). RESEARCH METHODOLOGY. Study and evaluation of research methods and of problems in the major fields of psychology.

Credit, 2 each semester.

800. MASTER'S THESIS.

Credit, 8-10.

900. DOCTORAL DISSERTATION.

Credit, 30.

COURSES OPEN TO BOTH GRADUATE AND UNDERGRADUATE STUDENTS

(For either major or minor credit)

542. ADVANCED EXPERIMENTAL PSYCHOLOGY. Instrumentation, methods, and techniques of experimental psychology.

Offered spring semester.

Prerequisites, Psych 101, 141.

May be repeated for maximum of 6 credits.

545. STATISTICAL INFERENCE IN PSYCHOLOGY. Application of statistical procedures to analysis of psychological data and to problems of measurement in psychology and related fields.

Two class hours, one 2-hour laboratory period.

Offered fall semester.

Prerequisites, Psych 101; Psych 145 or Stat 121.

550. PHYSIOLOGICAL PSYCHOLOGY.

Neural bases of behavior, current issues in physiological psychology; psychobiological investigations of learning, sensory processes, motivation, and instinctive behavior. Prerequisites, Psych 101 and Zool 101 or permission of instructor.

551. LABORATORY IN PHYSIOLOGICAL PSYCHOLOGY.

Development of skills in laboratory techniques used in physiological psychology, including animal neurosurgery, electrophysiological stimulation and recording, and assessment of drug-behavior interactions.

Two 2-hour laboratory periods.

Prerequisites, Psych 141 and Psych 250.

Credit, 2.

552. DRUGS AND BEHAVIOR.

The psycho-biological foundations of drug-behavior interactions. The neural and neurochemical basis of behavior, basic pharmacology, drugs that affect mood and their mode of action, the psychological and physical bases of drug dependence and addiction, experimental approaches to psychopharmacology.

Offered spring semester.

Prerequisites, Psych 250 or permission of instructor.

563. PSYCHOLOGY OF ADOLESCENCE.

The development and emotional, social, and intellectual adjustment of the individual during the adolescent years. Prerequisite, Psych 101.

589. ORGANIZATIONAL PSYCHOLOGY.

An introduction to the field of organizational psychology; conceptions of schools, hospitals, prisons, industries, and other organizations as complex social systems; individual adaptation in organizational settings; organizational development and personal change.

Offered spring semester.

590. INDUSTRIAL PSYCHOLOGY.

Psychological principles underlying personnel selection and training, communication, and decision-making in industry.

Offered fall semester.

Prerequisite, Psych 101.

606 (I). COMPARATIVE PSYCHOLOGY.

Emphasis on experimental investigations in a wide

range of species. Topics include sensory and physiological systems, learning, and early experience. Offered fall semester.
Prerequisite, permission of instructor.

611. PSYCHOLOGICAL TESTS.
Survey of tests of intelligence, aptitude, interest, personality, and adjustment. Test rationale, construction, characteristics, uses, and evaluation emphasized. Two class hours, one 2-hour laboratory period. Offered spring semester.
Prerequisite, Psych 101.

645. INTRODUCTION TO QUANTITATIVE THEORIES OF BEHAVIOR.
Introduction to quantification of theories of learning, retention, choice, perception, and the interaction of individuals in group situations. Offered spring semester.
Prerequisite, Psych 145, 305, or permission of instructor.

COURSES NOT FOR MAJOR CREDIT

(No graduate credit for students majoring in psychology)

501. PSYCHOLOGY OF ADJUSTMENT.
Problems of personality development and adjustment. Psychological nature of man, conflict, and thinking and adjustment.
Prerequisite, Psych 101.

510. SENSATION AND PERCEPTION.
Methods, data, and theories of the functioning of various sensory systems. Topics include a survey of basic sensory processes in the cutaneous sense, audition, vision, gustation, and olfaction, and higher perceptual processes in selected senses.
Prerequisite, Psych 101.

511. LABORATORY IN SENSATION AND PERCEPTION.
Selected laboratory exercises in audition and vision and a semester project chosen by the student, with the aid of the instructor, in some area of sensation or perception. Two 2-hour laboratory periods.
Prerequisites, Psych 141 and 210. *Credit, 2.*

520. LEARNING AND THINKING.
A general survey of animal and human learning and performance. Topics include factors affecting acquisition, generalization, discrimination, extinction, and transfer in animals and humans; memory; and higher cognitive processes in humans.
Prerequisite, Psych 101.

521. LABORATORY IN HUMAN LEARNING.
Introduction to methods used in investigating rote verbal learning, concept formation, short-term retention, verbal conditioning, artificial language, learning, motor-skills, and other phenomena in human learning and retention. Two 2-hour laboratory periods.
Prerequisites, Psych 141 and 220. *Credit, 2.*

522. LABORATORY IN ANIMAL LEARNING.
Introduction to methods used in investigating classical conditioning and operant behavior primarily using laboratory animals as subjects. Topics include: acquisition, generalization, discrimination, extinction, and transfer phenomena. Two 2-hour laboratory periods.
Prerequisites, Psych 141 and 220. *Credit, 2.*

530. EMOTION AND MOTIVATION.
Introduction to theories and research on the nature and determinants of motivation. Topics include instinct, behavior energization concepts, biological and acquired

bases of emotions and motives, frustration, conflict, and stress.
Prerequisite, Psych 101.

531. LABORATORY IN MOTIVATION.
Methods of investigating motivation, including both laboratory and field studies using human and animal subjects. Includes individual and small group projects. Two 2-hour laboratory periods.
Prerequisites, Psych 141, 230. *Credit, 2.*

560. CHILD BEHAVIOR AND DEVELOPMENT.
Psychological development of the child, including theories, methods, and data of child-behavior studies.
Prerequisite, Psych 101.

561. LABORATORY IN CHILD BEHAVIOR AND DEVELOPMENT.
Selected experiments investigating perceptual, conceptual, learning, and social processes in children. Two 2-hour laboratory periods.
Prerequisites, Psych 141 and 260. *Credit, 2.*

562. CHILD PSYCHOLOGY.
Psychological development of the child, including language, emotions, intelligence, social behavior, motivation and personality.
Not open to psychology majors.
Prerequisite, Psych 101.

565. INTRODUCTION TO THE STUDY OF EXCEPTIONAL CHILDREN.
The etiology, diagnosis, characteristics, education, and prognosis of deviations in mental, physical, and socio-emotional development.
Prerequisites, Psych 101, 262, or permission of instructor.

570. PERSONALITY.
Introduction to the scientific study of personality. Personality development, structure, and dynamics from major theoretical orientations.
Prerequisite, Psych 101.

571. EXPERIMENTAL STUDY OF PERSONALITY.
Review and evaluation of research approaches to the study of personality. Data, theories, and methods of investigation. Selected projects. Two 2-hour laboratory periods.
Prerequisites, Psych 141 and 270. *Credit, 2.*

580. SOCIAL PSYCHOLOGY.
Introduction to the principles and study of social behavior. The psychological factors involved in attitude formation and change, communication and persuasion, and small group processes.
Prerequisite, Psych 101.

581. LABORATORY IN ATTITUDES AND OPINIONS.
Methods and research concerning attitude formation and change, attitude and opinion measurement, communication and persuasion. Two 2-hour laboratory periods.
Prerequisites, Psych 141 and 280, or permission of instructor. *Credit, 2.*

582. LABORATORY IN GROUP BEHAVIOR.
Methods and research concerning the behavior of individuals in groups. Interpersonal attraction, social interaction and influence, power and conflict, communication, group structure, leadership, and productivity. Two 2-hour laboratory periods.
Prerequisites, Psych 141 and 280, or permission of instructor. *Credit, 2.*

601. EDUCATIONAL PSYCHOLOGY.

Psychological facts and principles of development, learning, and measurement as applied to educational situations.

Two class hours, one 2-hour laboratory period.

Prerequisite, Psych 101.

605. HISTORICAL AND CONTEMPORARY SYSTEMS.

General structure of psychological theory; analysis and comparison of historical systems in the tradition of British empiricism-associationism and Continental rationalism, and of derivative near-contemporary and contemporary mentalistic, functionalistic, and behavioristic systems.

Prerequisite, Psych 101.

625. ABNORMAL PSYCHOLOGY.

Etiology, symptoms, and therapy of behavior abnormalities including neuroses, psychoses, epilepsies, speech disorders, and mental deficiency.

Prerequisite, Psych 101.

631. CLINICAL PSYCHOLOGY.

Introduction of the theoretical approach and methods used in understanding and treating the psychologically-disturbed individual.

Two class hours, one 2-hour laboratory period.

Prerequisite, Psych 325 or permission of instructor.

665. THEORIES AND PRACTICE IN COUNSELING.

Theories, techniques, and tests necessary in counseling and guidance. Practice in organization and evaluating relevant data in the analysis of illustrative cases.

Two class hours, one 2-hour laboratory period. Offered spring semester.

Prerequisite, Psych 270 or 311 or permission of instructor.

RELATED COURSES

Computer and Information Science

503. FUNDAMENTALS OF CYBERNETICS.

585. CYBERNETICS AND THE BRAIN.

594. COMPUTERS AND SOCIETY.

782. COMPUTATIONAL CYBERNETICS.

783. ARTIFICIAL INTELLIGENCE.

784. ADVANCED PATTERN RECOGNITION.

Education

516. EVALUATION MODELS.

705. SEMINAR-APPLIED MULTIVARIATE ANALYSIS.

705. SEMINAR-PSYCHOMETRIC MODELS.

705. SEMINAR-EVALUATION DESIGN.

731. FACTOR ANALYSIS.

735. TEST THEORY.

820. RESEARCH SEMINAR IN EDUCATION.

Entomology

590. EVOLUTION.

611. INSECT BEHAVIOR.

Sociology

725. SYMBOLIC INTERACTION SEMINAR.

729. SOCIOLOGY OF SMALL GROUPS.

784. ADVANCED SOCIOLOGICAL THEORY.

785. COMPLEX ORGANIZATIONS.

797. SURVEY DESIGN AND ANALYSIS.

Speech

792. THEORIES OF HEARING.

Zoology

540. PRINCIPLES OF GENETICS.

600. VERTEBRATE ZOOLOGY.

650. ANIMAL BEHAVIOR.

670. COMPARATIVE PHYSIOLOGY.

680. DEVELOPMENTAL BIOLOGY.

750. SELECTED TOPICS IN ANIMAL BEHAVIOR.

755. SYSTEMATICS AND EVOLUTIONARY MECHANISMS.

770. COMPARATIVE NEUROPHYSIOLOGY.

780. PHYSIOLOGICAL REGULATORY MECHANISMS.

784. ENDOCRINOLOGY.

Public Health

GRADUATE FACULTY

WILLIAM A. DARITY, *Professor of Public Health and Head of Department*, B.S., Shaw University, 1948; M.S.P.H., North Carolina Central University, 1949; Ph.D., University of North Carolina at Chapel Hill, 1964.

TYZZ-LANG CHEN, *Assistant Professor of Public Health*, B.Ed., National Taiwan N. University, 1962; M.A., University of Maryland, 1966; Ph.D., Ohio State University, 1970; M.P.H., University of California, Berkeley, 1971.

SALVATORE DINARDI, *Assistant Professor of Public Health*, B.A., Hofstra University, 1965; Ph.D., University of Massachusetts, 1971.

ROBERT W. GAGE, *Professor of Public Health*, B.S., Massachusetts, 1938; M.D., Harvard, 1942.

JOYCE GOGGIN, *Assistant Professor of Public Health*, D.V.M., Washington State University, 1962; M.P.H., Johns Hopkins University School of Hygiene and Public Health, 1965.

ALAN J. CROSS, *Associate Professor of Public Health*, B.A., University of California, Los Angeles, 1956; M.A., 1957; Ph.D., University of North Carolina, 1962.

WARREN LITSKY, *Commonwealth Professor of Environmental Sciences and Public Health*, B.A., Clark 1945; M.S., Massachusetts, 1948; Ph.D., Michigan State University, 1951.

A. TAHER MOUSTAFA, *Associate Professor of Public Health*, M.D., Cairo University, 1954; M.P.H., University of Alexandria, 1959; Dr.P.H., University of California at Berkeley, 1962.

JESSE S. ORTIZ, *Associate Professor of Public Health*, B.Ph., Northwestern University, 1961; M.S., Loyola University, 1965; M.P.H., University of Michigan, 1968; Dr.P.H., University of Michigan, 1970.

HOWARD A. PETERS, *Associate Professor of Public Health*, B.A., University of Omaha, 1951; M.P.H., University of North Carolina at Chapel Hill, 1958; Ph.D., 1965.

JEROME S. PETERSON, *Adjunct Professor of Public Health*, B.S., Syracuse, 1925; M.D., College of Physicians and Surgeons, Columbia, 1931; M.P.H., Harvard School of Public Health, 1939.

ROBERT W. TUTHILL, *Assistant Professor of Public Health*, B.A., University of Massachusetts, 1956; M.A., University of Pennsylvania, 1961; Ph.D., University of North Carolina at Chapel Hill, 1970.

COURSE OF STUDY

Students interested in obtaining graduate preparation in the various areas of public health will be accepted in the Department of Public Health if their previous academic background indicates an aptitude for graduate study. Applicants must satisfy the entrance requirements of the Graduate School. Usually applicants will be best prepared by having completed an undergraduate major in either the physical sciences, biological sciences, public health, or the social and behavioral sciences. For all students a minimum background is essential in both the social and behavioral sciences and the biological sciences. In special circumstances, students will be accepted with other undergraduate study majors.

The course of study is organized to prepare students for concentration in:

- 1. Air pollution.
- 2. Biostatistics and/or health statistics.
- 3. Epidemiology.
- 4. Community health education.
- 5. Environmental health.
- 6. Health laboratory science.

The course of study leads to the Master of Science degree. Students will also be prepared for advanced graduate studies. The Department encourages an interdisciplinary academic and research approach and will arrange a cooperative program with other departments when this is in the interest of the student. Students who have completed undergraduate study in public health or have followed courses similar or parallel to the Public Health 500-600 series will not be permitted to take such courses for graduate credit.

Also, students who have deficiencies in certain specific, essential, undergraduate courses will be required to take such courses without graduate credit.

Each applicant's situation is handled on an individual basis.

Examples of typical programs of study in each of the areas of concentration are available.

Interested persons may secure this information by writing to the Department.

RESEARCH

All graduate students in the Department of Public Health must carry out some form of investigation or research as a requirement for the Master of Science degree. This will be in the form of a thesis or a special problem conducted under the direction of a departmental faculty member who is also a member of the Graduate Faculty. Before receiving the Master of Science degree, all students must pass an oral comprehensive examination. This examination is given by at least three members of the graduate Faculty. The comprehensive examination covers the research project as well as the subject matter the student will have covered leading up to the Master of Science degree.

COURSES REQUIRED OF ALL STUDENTS FOR MASTER OF SCIENCE DEGREE

The following courses, with some minor adjustments, are required of all Public Health majors:

	Credits
PH 683. Introduction to Health Administration.	4
PH 661. Principles of Environmental Health.	3
PH 678. Principles of Epidemiology.	3
PH 675. Public Health Statistics.	3
PH 776. Evaluation of Public Health Research.	3
PH 795 and 796. Seminar.	1 ea. sem.
PH 700. Special Problems.	1-6
or	or
PH 800. Master Thesis.	6-12

Courses to fulfill requirements for concentration in the area of public health elected by the student (air pollution, biostatistics and/or health statistics, health administration, community health education, environmental health, epidemiology or health laboratory science) are selected in cooperation with the faculty adviser. The total program and the topic for investigation or research must have the approval of the Department's Graduate Coordination Committee. Two academic years is the normal period required for satisfying requirements for the Master of Science degree in the Department of Public Health. Students following the community health education sequence in preparation to become a community health educator must take Public Health 782. (This program is accredited by the American Public Health Association. Public Health 782 is one aspect of accreditation.)

MASTER OF ARTS IN TEACHING (MAT) PROGRAM IN PUBLIC HEALTH

The Master of Arts in Teaching degree (MAT) is offered in cooperation with the School of Education to candidates who are interested in health-education teaching at the secondary and elementary school levels. The degree is also offered to candidates interested in general health teaching and health-technology teaching (medical technology, environmental health, etc.) at the community-college level. Both programs require 36 graduate credits, distributed as follows: Education courses, 6 credits. Education practicum, 6 credits. At least 12 credits in Public Health, to include at least two courses and two sem-

inars. The remaining credits (at least 12) will be taken in the Department of Public Health or must be courses approved by the Department of Public Health.

Prerequisites for admission: For all candidates, a bachelor's degree in an appropriate discipline or equivalency.

For Medical Technology candidates, the MT (ASCP) certification and at least one year's experience on a professional level, or its equivalency. Applicants interested in the MAT in public health should be sure to indicate this on their application and also designate public health as their major interest.

ALL COURSES CARRY 3 CREDITS UNLESS OTHERWISE SPECIFIED

(Courses currently under revision; please contact department for current course listing.)

COURSES OPEN TO GRADUATE STUDENTS ONLY

700. SPECIAL PROBLEMS IN PUBLIC HEALTH. Special investigational or research problems in public health for advanced students. The scope of the work can be varied to meet specific conditions. *Credit, 3-6.*

701. PUBLIC HEALTH LAW. Constitutional and social bases for public health laws. The development of statutes and regulations and their effects on social problems, including review of court decisions and the preparation of administrative regulations. *Mr. Hartzler.*

702. ADVANCED METHODS IN HEALTH EDUCATION. Health-education efforts that have influenced community health. Individual study, programming, and research methods. *Prerequisite, permission of instructor.*

703. PLANNING OF ENVIRONMENTAL HEALTH PROGRAMS. Principles of environmental health as translated into community programs planned to meet desirable objectives. Studies of different surveys and rating systems as measuring devices for the effectiveness of programs. *Prerequisite, PH 661 or equivalent. Mr. Peters.*

706. ADVANCED EPIDEMIOLOGY. The application of epidemiological techniques to the study of a specific health problem. *Prerequisite, PH 672. Epidemiological Investigation.*

773. AIR SAMPLING AND ANALYSIS. Applications of fluid mechanics and gas laws to measurement and collection of gaseous atmospheric pollutants including those which are injurious to health. Manual and automated analysis of these pollutants by electrochemical, spectrophotometric, and gravimetric techniques. *Two class hours, one 3-hour laboratory period. Prerequisite, PH 632 or permission of instructor. Mr. DiNardi.*

776. EVALUATION OF PUBLIC HEALTH RESEARCH. Principles of statistics applied to the evaluation of public health research. *Mr. Gross.*

778. SURVIVAL THEORY IN PUBLIC HEALTH AND SCIENCE. Application of statistical distribution theory to assess and predict survival in human beings and animals who are, for example, exposed to a radiation hazard, as well as electrical and mechanical equipments.

Prerequisites, PH 675 and Math 616, or permission of instructor.

782. SUPERVISED FIELD TRAINING (INTERNSHIP).

For students majoring in public health. Opportunity for supervised field observation and professional experience in selected public health agencies. Assignments in either associate function or internship. Departmental staff; consultants in public health agencies. *Credit, 3-12.*

783. ORGANIZATION AND MANAGEMENT OF MEDICAL CARE PROGRAMS.

Prevailing organizational patterns for delivery of medical-care services. Cost and methods of payment, health personnel and facilities, planning and evaluation of medical-care programs. Governmental role in the provision of medical care. Health amendments to the Social Security act. National and international trends. *Prerequisite, permission of instructor. Mr. Moustafa.*

795 (I), 796 (II). SEMINAR.

Lectures and reports on current literature and special topics. *Credit, 1 each semester; maximum credit, 4. Mr. Berger.*

800. MASTER'S THESIS. Independent research leading to the preparation of a thesis on a public health subject. Results should be suitable for publication. *Credit, 3-10.*

COURSES OPEN TO BOTH GRADUATE AND UNDERGRADUATE STUDENTS

563. INSTITUTIONAL HYGIENE AND SANITATION.

Application of bacteriology to the prevention of food poisoning. Evaluation of sanitary measures designed to prevent disease transmission via food and institutional environments. Role of governmental agencies. *Mr. Wisnieski.*

564. MICROSCOPY OF WATER. Microscopic forms of life, exclusive of bacteria. Counting and control of plankton in potable waters. Elements of limnology. *Three class hours, one 2-hour laboratory period. Mr. Wisnieski.*

601. PRINCIPLES OF COMMUNITY HEALTH EDUCATION. Principles of health education. Exploration of methods and approaches to community health, community dimensions, and community potential. Types and use of various methods leading to community action. *Three class hours, one 2-hour laboratory period. Prerequisite, permission of instructor. Credit, 4.*

602. COMMUNITY DEVELOPMENT IN HEALTH EDUCATION.

Latest approaches in community development and community organization procedures. Exploratory readings, field assignments; emphases on leadership development and on coordinated community action. *Prerequisite, permission of instructor.*

604. SCHOOL HEALTH.

The principal concepts, methods, and dynamics of the organization of a school health program at the elementary and secondary level. Stress on the planning and teaching in problem areas (i.e., sex education, mental health, and drugs). *Prerequisite, junior or senior standing or permission of instructor. Mr. Chen.*

605. CURRENT ISSUES IN HEALTH EDUCATION.

Latest issues in the field of health. Emphasis on controversial issues such as sex, drugs, and suicide education. *Mr. Chen.*

611. HUMAN SEXUALITY AND SEX EDUCATION.
Human sexuality in relation to modern life. Emphasis on human sexuality as it may appear in the infant, the child, the adolescent, and the young married adult.
Prerequisite, permission of instructor.

612. PUBLIC HEALTH AND FAMILY PLANNING.
Public health problems associated with family health and population limitation. Historical factors, limitation methods, and barriers and facilitators related to family health and size.
Prerequisite, permission of instructor. Mr. Darity.

631. INTRODUCTION TO OCCUPATIONAL HEALTH.
The relation of the occupational environment to health, efficiency, and well-being of workers. Emphasis on industrial hygiene aspects of toxic materials and physical stresses.
Prerequisites, permission of instructor. Mr. Peters.

632. INTRODUCTION TO AIR POLLUTION.
Effects of atmospheric air contamination on man and his environment. Nature and behavior of particulate and gaseous components of air, sources and control of pollutants, atmospheric sampling and analysis, biological effects, air-quality standards.
Prerequisite, permission of instructor. Mr. Peters.

637. INTRODUCTION TO RADIATION PROTECTION.
Effect and control of radiation in the mammalian system. Includes sources, measurements, radio-sensitivity, radiation chemistry, cellular effects and acute and delayed effects in occupational, medical, and environmental exposures.
Prerequisite, permission of instructor.

661. PRINCIPLES OF ENVIRONMENTAL HEALTH.
The application of scientific knowledge to the control of the environment in relation to man's health and well being. Air, water, waste disposal, food, housing, vector control, accidents, noise, ionizing radiation, and other physical and chemical stresses are considered.
Prerequisites, introductory courses in biological or physical sciences and permission of instructor. Mr. Peters.

662. ENVIRONMENTAL HEALTH PRACTICES.
The concepts of science and technology used by the environmental health practitioner in the control of man's environment. Primarily for environmental health and engineering majors. Water, wastewater, solid wastes, food, vector control, housing and accident control measures.
Prerequisite, permission of instructor. Mr. Peters.

672. EPIDEMIOLOGICAL INVESTIGATION.
Methods for the collection and use of mortality and morbidity data in epidemiological perspective of health. General approaches for (1) describing the patterns of disease in groups of people and (2) elucidating the various processes involved in creating the differing levels of health in human groups. Lecture and lab examples of a wide range of contemporary health problems.
Credit, 4. Mr. Tuthill and Ms. Goggin.

679. BASIC PUBLIC HEALTH LABORATORY PROCEDURES.
Standard methods used in present-day applied bacteriology; soils, dairy products, water and shellfish, and air. Two class hours, two 2-hour laboratory periods.
Prerequisite, Microbiol 140 or permission of instructor. Mr. Litsky and Mr. Ortiz.

680. ADVANCED PUBLIC HEALTH LABORATORY PROCEDURES.
Public health laboratory procedures; field collection of

samples, stream pollution study, food poisoning and infection, standard methods of food analysis.
One 4-hour and one 2-hour laboratory period.
Prerequisite, Microbiol 679 or permission of instructor. Mr. Litsky.

683. INTRODUCTION TO HEALTH ADMINISTRATION.
Introduction to the philosophy, nature, and scope of modern health services. Discussion of major health issues and programs. Organization of health services by local, national, and international health agencies.
Prerequisites, Soc 101 and Zool 101, or permission of instructor. *Credit, 4.* Mr. Moustafa.

684. ORGANIZATION AND ADMINISTRATION OF HEALTH PROGRAMS.
The organization of health programs to meet the needs of the people. Emerging health problems and approaches to their solution. Emphasis on comprehensive planning and evaluation procedures.
Prerequisite, PH 683 or permission of instructor. *Credit, 4.* Mr. Moustafa.

PARTIAL LIST OF COURSES IN OTHER SCHOOLS AND DEPARTMENTS FOR WHICH MAJOR CREDIT WILL BE GIVEN IN THE DEPARTMENT OF PUBLIC HEALTH

- BA 742. Organizing for Production.
- BA 751. Principles and Policies of Administration.
- BA 752. Administrative Practices.
- Econ 562. American Economic History.
- Econ 566. Economic Development.
- Econ 571. Comparative Economic Systems.
- Econ 582. Urban Economics.
- Educ 515. Theory and Practice in Interviewing.
- Educ 516. Evaluation Models.
- Educ 518. Research Methods in Education.
- Educ 535. Education Media and Technology.
- Educ 550. Conceptions of Liberal Education.
- Educ 551. Foundations of Education.
- Educ 554. Educational Anthropology.
- Educ 655. Introduction to Statistics and Computer Analysis.
- Educ 713. Human Appraisal and Evaluation.
- Educ 744. History of Higher Education in America.
- Educ 881. Comparative Education.
- Educ 884. Educational Sociology.
- Chem 523. General Biochemistry.
- Chem Eng 660. Air Pollution (Control) Processes.
- 571. Introduction to Environmental Pollution Control.
- 672. Waste and Wastewater Analysis.
- 674. Radiological Health Engineering.
- 675. Surface-Water Quality Control.

Microbiol 580. Pathogenic Bacteriology.

Microbiol 610. Immunology.

Microbiol 620. Virology.

Microbiol 710. Advanced Immunology.

Psych 580. Social Psychology.

Psych 601. Educational Psychology.

Psych 780. Advanced Social Psychology.

Sociol 547. Elementary Statistics.

Sociol 551. Urban Sociology.

Sociol 561. Population Problems.

Sociol 587. Sociology of Mental Disorders.

Sociol 722. Sociology of Education.

Sociol 731. Social Gerontology.

Sociol 732. Seminar in the Family.

Sociol 764. Population Characteristics and Socio-Economic Change.

Sociol 765. Techniques of Demographic Analysis.

Sociol 766. Human Ecology.

Stat 531 (I), 532 (II). Introduction to Fundamentals of Statistical Inference.

Stat 551. Elementary Statistics.

Stat 561. Advanced Statistical Analysis of Experimental Data I.

Stat 571. Survey Sampling.

Stat 581. Multivariate Analysis (Methods).

Zool 530. Systems of the Human Body.

Regional Planning

(See Landscape Architecture)

Slavic Languages and Literatures

GRADUATE FACULTY

MAURICE I. LEVIN, *Head of the Department of Slavic Languages and Literatures and Professor*, B.A., Boston University, 1953; M.A., Harvard, 1958; Ph.D., 1964.

GEORGE IVASK, *Professor*, Ph.D., Harvard, 1955.

J. JOSEPH LAKE, *Assistant Professor*, B.A., Georgetown University, 1964; M.A., Yale, 1968; Ph.D., 1969.

ROBERT A. ROTHSTEIN, *Associate Professor*, B.S., Massachusetts Institute of Technology, 1960; M.A., Harvard, 1961; Ph.D., 1967.

LASZLO M. TIKOS, *Professor*, M.A., University of Debrecen, Hungary, 1954; Ph.D., University of Tübingen, Germany, 1962.

MASTER OF ARTS

Prerequisites for admission: A bachelor's degree with a major in Russian language and literature or area studies, plus an indication of ability to do successful graduate work. Deficiencies in literary background and/or insufficient command of spoken or written Russian must be remedied before the candidate can be admitted to certain courses required for the degree.

Language: For this degree the student must have, or must acquire, a reading knowledge of at least one major language other than Russian or English, preferably French or German. In addition, the student is required to demonstrate proficiency in speaking, understanding, reading and writing contemporary standard Russian.

Program of study: A total of 30 credits, at least 24 of which must be earned in this Department. The student is required to pass a comprehensive examination in order to demonstrate 1) proficiency in the language itself; 2) familiarity with the whole body of Russian literature; 3) thorough knowledge of the structure and history of the Russian language; 4) knowledge of Russian and Soviet history and culture.

ALL COURSES CARRY 3 CREDITS UNLESS OTHERWISE SPECIFIED

COURSES OPEN TO GRADUATE STUDENTS ONLY

(For either major or minor credit)

SLAVIC

700. PROBLEMS COURSE.

Directed study in some special area of literature or linguistics. *Credit, 3-12.*

710. OLD CHURCH SLAVIC.

Introduction to the phonology, morphology, and syntax of Old Church Slavic; selected readings and textual analysis.

Required of all first-year graduate students. Mr. Lake.

770. PROSEMINAR I. BIBLIOGRAPHY AND METHODOLOGY.

An introduction to tools and methods of research. Designed to acquaint students with major reference works, scholarly publication, and basic approaches to literary criticism. Required of all candidates for graduate degree. Offered first semester.

770. PROSEMINAR II AND III. INTERPRETATION OF TEXTS.

Problems in philology or in literary interpretation. Reports and papers on selected texts.

Prerequisite, Slavic 770. *Credit, 3 each semester.*

780. SEMINAR.

Close study of a single topic, author or work. One main purpose is to suggest projects for independent research to advanced students. Subject matter varies from year to year. *Credit, 3-9.*

RUSSIAN

711. READINGS IN RUSSIAN LITERATURE OF THE EARLY PERIOD.

Close reading and analysis of the major works of Rus-

sian literature before Pushkin. Emphasis on the place of each in the development of Russian literature. Conducted in Russian with readings in the original.

Mr. Tikos.

712. READINGS IN RUSSIAN LITERATURE SINCE PUSHKIN.

Close reading and analysis of the major works of Russian literature since Pushkin. Emphasis on the place of each in the development of Russian literature. Conducted in Russian with readings in the original.

Mr. Ivask.

800. MASTER'S THESIS.

Credit, 6-9.

COURSES OPEN TO BOTH GRADUATE AND UNDERGRADUATE STUDENTS

(For either major or minor credit)

SLAVIC

559. THE SLAVIC PEOPLES, THEIR LANGUAGES AND CIVILIZATIONS.

A survey of the historical, social, intellectual, and cultural evolution of the Slavic peoples from the earliest times to the present. Emphasis on the non-Russian Slavs. Conducted in English; no language prerequisite.

Mr. Rothstein.

RUSSIAN

553. DOSTOEVSKY.

Historical and literary background. Close text analysis. Student reports. Readings of selected works in the original required of Russian majors.

Mr. Tikos.

554. TOLSTOY.

Historical and literary background. Close text analysis. Student reports. Readings of selected works in the original required of Russian majors.

Mr. Tikos.

556. RUSSIAN DRAMA.

Drama in the originals from the beginning to the establishment of a national theatre culminating in plays of Ostrovsky, Chekhov, Gorky.

Prerequisite, proficiency in Russian.

Mr. Tikos.

557. SOVIET LITERATURE.

The beginnings and development of Soviet prose, drama, and criticism from Gorky to Sholokhov and Pasternak.

Mr. Tikos.

558. RUSSIAN POETRY.

Russian poetry in the originals, from the early 19th century to the present. Emphasis on the major poetic trends. Prerequisite, proficiency in Russian.

Mr. Ivask.

566. RUSSIAN PHONETICS.

Detailed analysis of the Russian sound system. Articulation and intonation, largely in comparison with the English sound system. Recommended for those preparing to teach Russian.

Prerequisite, proficiency in Russian.

Mr. Levin.

610. THE TEACHING OF RUSSIAN.

A systematic analysis of the major linguistic problems facing the teacher of Russian and the methods used in solving them.

Prerequisite, Russian 665 or permission of instructor.

Mr. Levin.

619. PUSHKIN.

The most important works of Pushkin, prose and poetry: *Eugene Onegin*, *Boris Godunov*, *The Captain's Daughter*, *The Bronze Horseman*, *Poltava*, and others. Facility in speaking and writing Russian required. Conducted on a seminar basis with each student actively participating.

Mr. Ivask.

620. GOGOL.

The most important works of Gogol: *The Inspector-General*, *Dead Souls*, *The Overcoat*, and selected pas-

sages from his *Correspondence with Friends*, and other works. Facility in speaking and writing Russian required. Conducted on a seminar basis with each student actively participating.

Mr. Ivask.

631. NINETEENTH-CENTURY RUSSIAN CRITICISM.

Criticism of the 19th century: Belinsky, Chernyshevsky, Dobrolyubov, Pisarev, and others. Facility in speaking and writing Russian required. Conducted on a seminar basis with each student actively participating.

Mr. Ivask.

663. THE HISTORY OF THE RUSSIAN LANGUAGE.

Historical development of the Russian language, its relation to other languages, changes in sound, form, and vocabulary from the earliest period to the present.

Prerequisite, proficiency in Russian.

Mr. Lake.

665. STRUCTURE OF RUSSIAN.

Descriptive analysis of the morphology of contemporary standard Russian; emphasis on selected problems of derivation.

Prerequisite, proficiency in Russian.

Mr. Levin.

666. CONTRASTIVE STRUCTURES OF RUSSIAN AND ENGLISH.

Contrastive analysis of Russian and English with emphasis on those elements of Russian structure that differ significantly from English.

Prerequisite, Russian 665.

Mr. Rothstein.

COURSES NOT FOR MAJOR CREDIT

419, 429, 439. RUSSIAN READING COURSE.

Intensive study of Russian grammar. Emphasis on developing reading ability only. Appropriate for graduate students preparing for their reading examinations.

No credit.

449. RUSSIAN EXPOSITORY PROSE.

Readings in non-literary Russian texts from a wide variety of scientific and technical fields. Emphasis on developing reading skill in the student's specialized field.

Prerequisite, three semesters of Russian or equivalent.

No credit.

Sociology

GRADUATE FACULTY

N. JAY DEMERATH, III, *Chairman of the Department of Sociology and Professor*, B.A., Harvard, 1958; M.A., University of California at Berkeley, 1961; Ph.D., 1964.

LEWIS M. KILLIAN, *Professor and Director of Graduate Studies in Sociology*, B.A., University of Georgia, 1940; M.A., 1941; Ph.D., Chicago, 1949.

ALBERT CHEVAN, *Assistant Professor*, B.S., Cornell, 1953; M.S., Connecticut, 1957; Ph.D., University of Pennsylvania, 1968.

ROLAND J. CHILTON, *Associate Professor*, B.A., Monmouth, 1951; M.A., Wisconsin, 1958; Ph.D., Indiana, 1962.

EDWIN D. DRIVER, *Professor*, B.A., Temple, 1945; M.A., University of Pennsylvania, 1947; Ph.D., 1956.

ROBERT R. FAULKNER, *Assistant Professor*, B.A., University of California at Los Angeles, 1963; M.A., 1965; Ph.D., 1968.

HILDA H. GOLDEN, *Associate Professor*, B.A., Skidmore, 1942; M.A., Duke, 1944; Ph.D., 1950.

MILTON M. GORDON, *Professor*, B.A., Bowdoin, 1939; M.A., Columbia, 1940; Ph.D., 1950.

JOHN P. HEWITT, *Associate Professor*, B.A., State University of New York at Buffalo, 1963; M.A., Princeton, 1965; Ph.D., 1966.

PAUL HOLLANDER, *Associate Professor*, B.A., University of London, 1959; M.A., University of Illinois, 1960; M.A., Princeton, 1962; Ph.D., 1963.

J. HENRY KORSON, *Professor*, B.A., Villanova, 1931; M.A., Yale, 1942; Ph.D., 1947.

MICHAEL LEWIS, *Associate Professor*, B.A., Brooklyn College, 1959; M.A., Princeton, 1962; Ph.D., 1967.

JOHN W. LOY, JR., *Associate Professor of Physical Education*.

JOHN F. MANFREDI, *Associate Professor*, B.A., University of Pennsylvania, 1942; M.A., Harvard, 1948; Ph.D., 1951.

SURINDER K. MEHTA, *Associate Professor*, B.A., Oregon, 1952; M.A., 1955; Ph.D., Chicago, 1959.

JOHN F. O'ROURKE, *Assistant Professor*, B.A., Massachusetts, 1956; Ph.D., Yale, 1963.

CHARLES H. PAGE, *Professor*, B.A., University of Illinois, 1931; Ph.D., Columbia, 1940.

PETER PARK, *Professor*, B.A., Columbia, 1953; M.A., Yale, 1955; Ph.D., 1958.

EUGENE B. PIEDMONT, *Associate Professor*, B.S., State University of New York, 1956; M.A., Rochester, 1959; Ph.D., Buffalo, 1962.

GERALD M. PLATT, *Associate Professor*, B.A., Brooklyn College, 1955; M.A., 1957; Ph.D., University of California at Los Angeles, 1964.

W. CLARK ROOF, *Assistant Professor*, B.A., Wofford College, 1961; M.A., North Carolina, 1969; Ph.D., 1971.

JON E. SIMPSON, *Associate Professor*, B.A., Ohio Wesleyan, 1954; M.A., Ohio State, 1958; Ph.D., 1961.

HANS SPEIER, *Robert M. MacIver Professor of Sociology and Government*.

RANDALL C. STOKES, *Assistant Professor*, B.A., California State College at San Diego, 1966; M.A., Duke, 1967; Ph.D., 1971.

GORDON F. SUTTON, *Associate Professor*, B.A., Wayne State, 1953; M.A., 1955; Ph.D., University of Michigan, 1959.

CURT TAUSKY, *Associate Professor*, B.A., Portland State, 1959; Ph.D., Oregon, 1963.

THOMAS O. WILKINSON, *Professor*, B.A., North Carolina, 1945; M.A., Duke, 1950; Ph.D., Columbia, 1957.

DAVID W. YAUKEY, *Professor*, B.A., Oberlin, 1949; M.A., Washington State, 1950; Ph.D., University of Washington, 1956.

The graduate program in sociology is divided into two tracks. One is for Master of Arts candidates; the other is for students who have been accepted into the Doctor of Philosophy degree program. These two tracks, however, are not completely separate programs; no courses are designed specifically for either track. Although students entering with a bachelor's degree are usually required to obtain a Master of

Arts degree en route to the Ph.D., the M.A. student may petition the Graduate Studies Committee for a waiver of the thesis requirement and thereby transfer to the doctoral program.

Students working toward either the Master of Arts or the Doctor of Philosophy degree in sociology must fulfill the general requirements of the Graduate School. The Doctor of Philosophy degree, while it has no specific course requirements, utilizes as its guiding principle the effective preparation of candidates to excel at two tasks: (1) the Comprehensive Examination and (2) the dissertation. The Comprehensive Examination is both written and oral. Since no relationship is assumed to obtain between specific courses taken and the high expectations of the Comprehensive Examination, course requirements are deliberately flexible. The written portion of the Comprehensive Examination covers two "special fields" selected by the student from areas of particular Department expertise, plus two required sections on sociological theory-methodology and research methods-statistics. A general oral examination, following the written sections, is an integral part of this requirement.

The Comprehensive Examination may not be taken until a minimum of 30 credits of graduate course work has been completed. Upon successfully passing the Comprehensive Examination, the student is admitted to candidacy for the Ph.D. degree and may proceed with the dissertation. A public oral final examination, not necessarily limited to the dissertation, is also required at its completion.

There is no general foreign-language requirement for degree qualification in sociology. Doctoral students may be expected to demonstrate satisfactory levels of competence in one or more languages other than English in those cases where such a requirement is deemed desirable by the faculty (e.g., a specific dissertation project).

Master's degree candidates must complete a minimum of 30 credits. Of these at least 24 credits must be for coursework; 6 are awarded for successfully completing a thesis. Normally, at least one of the required eight courses shall be taken in sociological theory, at least one in research methods, and another in statistics. The thesis, followed by a final oral examination, is required of all terminal master's degree candidates and, normally, all doctoral candidates.

Applicants for admission to graduate study in sociology are expected to be familiar with fundamental sociological concepts and literatures. Candidates may be asked to remove deficiencies, without receiving graduate credit, prior to or after admission.

Applications for admission will not be evaluated until all credentials have been received. These include Graduate Record Examination scores (both Aptitude and Advanced), two letters of recommendation, and transcripts of all previous academic study. Students requesting any form of financial aid are responsible for ensuring that all application materials are on file in the Graduate School by February 15 (for fall entrance) and October 1 (for spring entrance). The respective deadlines for filing applications for admission are April 15 and October 1, but early submission is strongly encouraged.

Applicants from countries whose native tongue is not English must, in addition to submitting all the above credentials, take the Test of English as a

Foreign Language (TOEFL). The Graduate School also requires all foreign students to take an English examination at the beginning of their initial semester, after admission. Remedial work may be prescribed on the basis of this examination.

A brochure, "Graduate Studies Program," which details the basic emphases and requirements of the Department's programs, is available on request to the Director of Graduate Studies.

ALL COURSES CARRY 3 CREDITS UNLESS OTHERWISE SPECIFIED

COURSES OPEN TO GRADUATE STUDENTS ONLY

700. SPECIAL PROBLEMS.

A special project in sociology.
Prerequisite, permission of instructor.

712. SOCIAL CHANGE.

Analysis of change as a process, especially the factors making for acceptance or rejection of innovations. Intrasocietal sources of change. Consequences of contacts between societies, with emphasis on underdeveloped areas.

Prerequisite, Soc 272 or permission of instructor.

713. SOCIOLOGY OF KNOWLEDGE.

Seminar for advanced students. The intellectual and social background of Karl Mannheim's and Max Scheler's *Sociology of Knowledge*. Discussion of selected writings. Comparisons with Durkheim, Sorokin, Mead. Influence of Mannheim's *Sociology of Knowledge* in Europe and America.

Mr. Speier.

714. CRIMINOLOGY.

Criminological theories, past and present, with emphasis on present research trends as they relate to theoretical formulations.

Prerequisite, permission of instructor.

Mr. Chilton, Mr. Driver, Mr. Simpson.

717. JUVENILE DELINQUENCY.

Theories of causation and treatment of delinquency.

Prerequisite, Soc 278 or permission of instructor.

Mr. Chilton, Mr. Driver, Mr. Simpson.

718. INDUSTRIAL SOCIOLOGY.

The role, status, and function of the worker in the industrial community; the impact of technological change on the community; analysis of selected occupational functions.

Mr. Tausky.

719. THE SOCIOLOGY OF RELIGION.

The relations of religious ideology and ecclesiastical organization to the total social institutional system. Attention to the religions of larger civilizations, especially Islam, Buddhism, medieval Christianity, Gentile paganism, Protestantism, and Judaism.

Mr. Manfredi, Mr. Roof.

720. CONTEMPORARY BELIEF SYSTEMS.

Comparative belief systems in modern industrial societies, including both theoretical and methodological considerations. Major topics include: problems of defining "religion" in contemporary society, traditional religion versus new forms of belief and ritual, theoretical approaches for analyzing modern belief systems, and problems of method and analysis.

Mr. Roof.

722. SOCIOLOGY OF EDUCATION.

Educational characteristics of an industrial population; comparative social structures and their school systems; educational selection and social stratification; educational development as effect and cause of social change; the internal organization and culture of schools and universities.

Prerequisites, one graduate course in sociological theory and one course in research methods.

725. SYMBOLIC INTERACTION SEMINAR.

The symbolic interactionist approach to social psychology and the social structure, including historical as well as contemporary contributions. Emphasis on the relation of symbolic interaction to other approaches in sociology, including ethno-methodology, the sociology of knowledge, and more positivist approaches to social psychology.

Mr. Hewitt.

729. SOCIOLOGY OF SMALL GROUPS.

Small human groups viewed as relatively permanent relational structures which emerge out of the process of social interaction. Theoretical discussion of concepts and logic of the process of emergence. Methodological discussion and readings on types, utility, and validity of experimental approaches to the explanation of development of relational structures. Emphasis on the ways in which situational factors contain and shape the group. Prerequisites, one prior graduate course in social psychology or permission of instructor.

Mr. O'Rourke.

731. SOCIAL GERONTOLOGY.

Implications of aging for society and the individual. Position of the aged in nonindustrial and industrialized societies. Changing roles of older people in the American family and the community.

Prerequisites, Soc 257 or permission of instructor.

Mr. O'Rourke.

732. SOCIOLOGY OF MEDICINE.

A survey of theory and research concerned with medical care as a social institution. The relation of social factors to illness, and social processes involved in medical education.

Prerequisite, Soc 286 or permission of instructor.

Mr. Piedmont.

733. POLITICAL SOCIOLOGY.

Analysis of the major topics and problems of political sociology in a comparative context. Special attention to contemporary social movements, political pluralism and extremism, the social roots of totalitarian and democratic societies, and the interaction between the political and nonpolitical institutions of society.

Mr. Hollander.

735. SOCIAL MOVEMENTS.

Analysis of the genesis, career, values, norms, structure, and endproducts of social movements, including studies of selected movements.

Mr. Killian.

736. COLLECTIVE BEHAVIOR.

The processes of interaction through which new social norms and forms of social organization emerge in the crowd, the public, and the social movement. Emphasis on principles of collective behavior as exemplified in the crowd, compact and diffuse.

Mr. Killian.

737. SEMINAR ON PUBLIC POLICY AND SOCIAL SCIENCES.

The mobilization of the social sciences for the solution of domestic social problems. More concerned with the strategy of applied social science in the context of social policy than with substantive issues. Topics include: evaluation as research, values in pursuit of research, support of research and the "knowledge for what" problem, and the relationship of science to planned social change.

Mr. Sutton.

740. CRISIS RESOLUTION AND COMMUNICATION.

Discussion of relevant concepts. Case studies on international crises from 1947-1968 with attention to the calculations of decision-makers.

Mr. Speier.

750. BLACK MAN IN AMERICA.

A socio-historical analysis of the interaction of the Black man and the American environment, from slavery to his migration to urban areas and subsequent isolation in the black ghetto. The role of power in the nature of black-white relations.

757. SEMINAR IN THE FAMILY.

Cross-cultural examination of family systems: their development, factors influencing changes, and directions of changes. Comparison of theoretical frames of relevance for theory construction and research: structural-functional, institutional, developmental, situational, and interactional. Review of methodological trends and developments: prediction studies, surveys, demographic analyses.

Prerequisite, Soc 257 or permission of instructor.

Mr. Korson, Mr. Lewis, Mr. Piedmont.

758. FAMILY AND KINSHIP COMPONENTS IN CONTEMPORARY SOCIAL PROBLEMS.

Relative importance of family and kinship in the analyses of contemporary sociologists; how this analysis informs inquiry into problems such as political and economic modernization, urbanization, stratification, the institutionalization of poverty, deviance, social control, and the community. Specific topics selected after consultation with students.

Mr. Lewis.

759. SOCIAL STRATIFICATION.

The major contemporary writers and their contribution to this area. Research techniques in the analysis of social class and social mobility.

Prerequisite, Soc 259 or permission of instructor.

Mr. Gordon.

762. DEMOGRAPHY.

An analysis of the demographic transition from peasant-agriculturalism to urban industrialism. Emphasis on the consequences of this transition for patterns of settlement and for fertility, mortality, and migration. Special studies are made of the demographic characteristics of non-industrialized nations as factors in their potential development.

Prerequisite, Soc 561 or permission of instructor.

Mrs. Golden, Mr. Wilkinson.

764. POPULATION CHARACTERISTICS AND SOCIOECONOMIC CHANGE.

Analysis of relationship between selected demographic characteristics and socioeconomic changes, with attention to the sociological uses of statistical information on the world's countries.

Prerequisite, Soc 561 or permission of instructor.

Mrs. Golden.

766. HUMAN ECOLOGY: COMMUNITY STRUCTURE AND INTERRELATIONS.

Theory and research of community functions and systems of communities with special reference to ecological organization and change.

Mr. Mehta.

772. POPULATION OF INDIA AND PAKISTAN.

Trends in population growth and its distribution among various social strata. The relative influence of fertility, mortality, migration, social organization, and cultural values on growth patterns.

Prerequisites, Soc 561 and 795.

Mr. Driver.

781. HISTORY OF SOCIOLOGICAL THEORY.

A survey of literature from classical times to the Utilitarians.

Prerequisite, Soc 282 or permission of instructor.

Mr. Manfredi.

782. THE DEVELOPMENT OF SOCIOLOGICAL THEORY.

Selected European and American contributors and their systems of theory, in biographical, historical, and sociological perspective.

Prerequisite, permission of instructor.

Mr. Page.

783. CONTEMPORARY SOCIOLOGICAL THEORY.

The literature from 1900 to the present.

Prerequisite, Soc 282 or permission of instructor.

Mr. Gordon.

784. ADVANCED SOCIOLOGICAL THEORY.

A methodological analysis of contemporary sociological

theory. Emphasis on theory construction, formalization and evaluation.

Prerequisite, Soc 282 or permission of instructor.

Mr. Roof.

785. COMPLEX ORGANIZATIONS.

Major theories of organization. Emphasis on recent findings on the determinants of individual behavior and organizational effectiveness.

Mr. Tausky.

792. PROBLEMS OF THEORETICAL ANALYSIS IN CONTEMPORARY SOCIOLOGY.

Alternative theoretical orientations, including neopositivism, functionalism, systems theory, phenomenology; problems of intellectual style, sociology and other disciplines; human perspectives; sociology of knowledge and of sociology.

Prerequisite, permission of instructor.

Mr. Page.

794. COMPUTER METHODS IN SOCIOLOGY.

A survey of computer-oriented analytical tools and data-processing systems available to the sociologist. The pace of the computer in research and the development of mathematical sociology. Students program and test a statistical or mathematical model.

Prerequisite, knowledge of some computer language.

Mr. Chevan.

795. RESEARCH METHODS.

Logical analysis of sociological inquiry; survey of major research techniques and examination of principal methodological problems in sociology.

Mr. Chevan, Mr. Chilton, Mr. Park.

796. RESEARCH METHODS.

Research techniques in sociology, including: formulating research objectives; collecting, processing, and analyzing data for a project organized around the problems of measurement in sociology.

Prerequisites, Soc 547 and 795.

Mr. Chevan, Mr. Chilton, Mr. Park.

797. SURVEY DESIGN AND ANALYSIS.

Design and analysis of descriptive and explanatory sample surveys. Special attention to the problems of longitudinal studies designed to evaluate the effects of a complex experience.

Prerequisite, Soc 795.

Mr. Chevan.

798. TECHNIQUES OF DATA COLLECTION IN SOCIAL RESEARCH.

The validity and reliability for various purposes of a number of observational techniques, including: the interview, the paper and pencil questionnaire, content analysis, and participant observation.

Prerequisite, Soc 795.

Mr. Chevan.

800. MASTER'S THESIS.

Credit, 6.

900. DOCTORAL DISSERTATION.

Credit, 15.

COURSES OPEN TO BOTH GRADUATE AND UNDERGRADUATE STUDENTS

547. ELEMENTARY STATISTICS.

Basic statistical principles and techniques with special reference to application in sociology.

Mr. Mehta, Mr. Park.

548. SOCIAL STATISTICS.

Introduction to principles of multivariate techniques, including sociology and related fields.

Prerequisite, Soc 547 or equivalent.

Mr. Mehta, Mr. Park.

551. URBAN SOCIOLOGY.

A comparative analysis of world urbanization with special reference to demographic characteristics of urban populations, urban ecology, and urban social structure.

Prerequisite, Soc 101 or permission of instructor.

Mrs. Golden, Mr. Mehta.

552. URBANIZATION AND THE CITY.

A comparative analysis of world urbanization, its trends, causes, and consequences. Regional variations in the

nature of urbanization and trends in major countries analyzed and related to major aspects of the spatial and social structure of cities.

Prerequisite, Soc 101. Mrs. Golden.

556. RACE RELATIONS.

Social, economic, and political aspects of racial problems in the U.S., with particular reference to the Negro and major ethnic groups. Problems resulting from contact of races in Asia, Africa, and South America. Mr. Gordon.

557. FAMILY.

Development of the customs of courtship and marriage of the contemporary American family; basic causes of changes and trends of the family including mate selection, marriage laws, marital prediction, husband-wife relations, and the role of the child. Mr. Korson.

558. SOCIAL INTERACTION.

The processes leading to the socialization of the group member, with emphasis on role properties, play, control models, and power definitions.

Mr. Hewitt, Mr. O'Rourke.

561. POPULATION PROBLEMS.

Physical and social factors which influence population change through births, deaths, and migration, with emphasis on the population problems of underdeveloped areas in the world today. Mr. Wilkinson.

565. THE POPULATION OF JAPAN.

A demographic survey of the history and development of modern Japan. Emphasis on the similarities and contrasts between Japan's demographic transition and that of the West, and the relevance of Japanese experience for contemporary underdeveloped nations.

Prerequisite, Soc 261 or equivalent. Mr. Wilkinson.

570. SOCIAL STRUCTURE OF INDIA.

Origins, distribution, and cultural traits of the major groups in India. Marriage, family, and caste patterns, and their relation to and positions in the economic and political system. Mr. Driver.

575. SOCIAL PROBLEMS.

Incidence, distribution, and interrelations among the major types of social tensions in human societies. Research and field trips likely. Mr. Lewis.

580. SOVIET SOCIETY.

Survey of the major social institutions, processes, and problems of Soviet society. Special reference to official and popular values and norms, stratification, social controls, the family, types of socialization and social problems (*i.e.*, crime, delinquency, the misuse of leisure, rural migration, etc.). The nature and usefulness of various theoretical models of Soviet society.

Mr. Hollander.

587. SOCIOLOGY OF MENTAL DISORDERS.

Influence of social factors on diagnosis, treatment, and possible etiology of mental disorders. Application of sociological concepts and methods in considering the nature and extent of mental disorders, epidemiology, resources for dealing with mental illness, mental hospitals, and the community in rehabilitation.

Prerequisite, Soc 286 or permission of instructor.

Mr. Piedmont.

592. BACKGROUND TO THE STUDY OF SOCIAL WELFARE.

Primarily for upper division and graduate students. Historical development and current status of British and American concerns about poverty in the context of the Industrial Revolution; sociological perspectives concerning differentials in access to economic security and social rewards; problems of measurement and planning as related to social policies. Mr. Sutton.

593. ISSUES IN SOCIAL POLICY PLANNING.

Primarily for upper division and graduate students. Focus on systematic policy planning; the role of research and development, and the role of the scientific community in domestic policy programming; and on selected substantive issues. Mr. Sutton.

660. TECHNIQUES OF DEMOGRAPHIC ANALYSIS.

The methods for gathering population data and the uses of these data to measure mortality, fertility, migration, and population composition. The theoretical interrelations among these factors. Methods for making population estimates and projections.

Prerequisite, Soc 261 or a course in statistics, or permission of instructor. Mr. Yaukey.

663. FERTILITY AND SOCIETY.

A review of past and present trends in fertility on a worldwide basis, an analysis of the social determinants and consequences of these trends, and an assessment of likely future trends.

Prerequisites, Soc 261 and permission of instructor.

Mr. Yaukey.

667. POPULATION THEORIES AND POLICIES.

The major theories concerning population growth, distribution, internal and international migration, and population quality. Theorists include the pre-Malthusians, Malthus, Marx, Keynes, Stouffer, Petersen, Myrdal, Clark, Coale, Keyfitz, Spengler, Davis, and others. The direct and social population policies; the unintended demographic consequences of the latter. Special attention to a cross-cultural analysis of the relations among sex status, social status, and human reproduction.

Mr. Driver.

INTERDEPARTMENTAL COURSES

SOCIAL SCIENCES 550. AFRICA, SOUTH OF THE SAHARA.

Introductory study of recent political, economic, and social developments in the principal countries in Africa, south of the Sahara.

Prerequisites, at least two courses in one or more of the following fields: government, economics, sociology.

Mr. Driver.

SOCIAL SCIENCES 569. INDIA AND SOUTH ASIA.

Introductory study of recent political, economic, and social developments in India and the countries of South Asia.

Prerequisites, at least two semester courses in one or more of the following fields: government, economics, sociology, anthropology.

Mr. Driver.

RELATED COURSES

PSYCH 780. ADVANCED SOCIAL PSYCHOLOGY.

PSYCH 781. ATTITUDES.

PSYCH 784. GROUP DYNAMICS.

PUBLIC HEALTH 761. SOCIAL EPIDEMIOLOGY.

Speech

GRADUATE FACULTY

JAMES E. LYNCH, *Chairman of the Department of Speech and Professor*, B.A., 1948; M.A., 1949; Ph.D., Michigan, 1955.

JANE BLANKENSHIP, *Associate Professor*, B.A., Akron, 1956; M.A., 1957; Ph.D., Illinois, 1961.

DORIS E. ABRAMSON, *Associate Professor*, B.A., Massachusetts, 1949; M.A., Smith, 1951; Ph.D., Columbia, 1967.

VINCENT M. BEVILACQUA, *Professor*, B.A., 1957; M.A., Emerson, 1958; Ph.D., Illinois, 1961.

MARYA BEDNERIK, *Assistant Professor*, B.A., Bennington, 1957; M.A., Bowling Green, 1962; Ph.D., Iowa University, 1968.

THOMAS W. BOHN, *Director of Graduate Studies in Speech and Assistant Professor*, B.A., Gustavus Adolphus College, 1963; M.S., Southern Illinois, 1964; Ph.D., Wisconsin, 1968.

KENNETH L. BROWN, *Associate Professor*, B.S., 1955; M.A., Syracuse, 1960; Ph.D., Northwestern, 1965.

RICHARD L. CONVILLE, JR., *Assistant Professor*, B.A., 1965; M.A., Samford, 1968; Ph.D., Louisiana State, 1970.

VERNON E. CRONEN, *Assistant Professor*, B.A., Ripon College, 1963; M.A., 1968; Ph.D., Illinois, 1970.

JEFFREY A. FIALA, *Assistant Professor*, B.S., 1967; M.F.A., Wisconsin, 1970.

RICHARD D. HARPER, *Assistant Professor*, B.A., Vermont, 1948; M.A., 1949; Ph.D., Wisconsin, 1951.

HARRY E. MAHNKEN, *Assistant Professor*, B.A., Geneva College, 1951; M.F.A., Carnegie Institute of Technology, 1955.

RONALD J. MATLON, *Assistant Professor*, B.A., Indiana State, 1960; M.S., 1962; Ph.D., Purdue, 1966.

JAY MELROSE, *Professor*, B.A., Queens College, 1948; M.A., 1953; Ph.D., Illinois, 1954.

TIMOTHY P. MEYER, *Assistant Professor*, B.A., Wisconsin State, 1967; M.A., 1969; Ph.D., Ohio University, 1970.

GARY P. NERBONNE, *Assistant Professor*, B.S., Central Michigan, 1959; M.A., 1962; Ph.D., Michigan State, 1967.

ARTHUR E. NIEDECK, *Professor*, B.A., Ithaca College, 1930; M.A., Cornell, 1942.

THEODORE L. NIELSEN, *Assistant Professor*, B.A., State University of Iowa, 1955; Michigan, 1958; Ph.D., Wisconsin, 1971.

E. HARRIS NOBER, *Professor*, B.A., 1951; M.A., Brooklyn College, 1952; Ph.D., Ohio State, 1957.

HENRY B. PEIRCE, JR., *Assistant Professor*, B.A., Massachusetts, 1950; M.A., Michigan, 1955; Ed.D., Boston University, 1970.

WILLIAM K. PRICE, *Assistant Professor*, B.A., Maryland, 1954; M.S., 1960; Ph.D., Wisconsin, 1964.

RONALD F. REID, *Professor*, B.A., Pepperdine College, 1950; M.A., New Mexico, 1951; Ph.D., Purdue, 1954.

MAURICE E. SHELBY, JR., *Associate Professor*, B.A., Washington, 1960; Ph.D., Ohio State, 1963.

MALCOLM O. SILLARS, *Professor*, B.A., 1948; M.A., Redlands, 1949; Ph.D., State University of Iowa, 1955.

HERMANN G. STELZNER, *Associate Professor*, B.A., Emerson, 1953; M.A., 1955; Ph.D., Illinois, 1957.

GARY L. STEWART, *Assistant Professor*, B.S., 1961; M.S., Brigham Young, 1962; Ph.D., Iowa, 1968.

RICHARD L. STROMGREN, *Assistant Professor*, B.A., Massachusetts, 1954; M.A., Northwestern 1958.

IAN B. THOMAS, *Associate Professor of Electrical Engineering*.

F. HAROLD TOKAY, *Assistant Professor*, B.S., St. Cloud State, 1960; M.A., 1962; Ph.D., Michigan State, 1967.

GILBERT C. TOLHURST, *Professor*, B.A., 1937; M.A., Brigham Young, 1946; Ph.D., Iowa, 1948.

KARL R. WALLACE, *Professor*, B.A., 1927; M.A., 1931; Ph.D., Cornell, 1933.

RICHARD L. WEAVER, II, *Assistant Professor*, B.A., 1964; M.A., Michigan, 1965; Ph.D., Indiana, 1969.

M. JAMES YOUNG, *Associate Professor*, B.A., Ashbury College, 1948; M.A., Michigan State, 1953; Ph.D., Michigan, 1961.

The Department of Speech offers work leading toward the M.A., M.F.A., and Ph.D. degrees.

Graduate study leading to the Ph.D. in speech with a concentration in rhetoric and public address emphasizes a combination of historical-critical and behavioral research methodologies for examining past and present phenomena of human communication.

Graduate study leading to the Ph.D. in mass communications emphasizes an interdisciplinary approach to the study of mass communications through which the graduate student interprets, consolidates, and makes more meaningful, information and research within the Department of Speech and from other areas of the University interested in mass media. The program is designed to prepare students for academic careers and for research and development positions in commercial and public media.

Graduate study leading to the Ph.D. in communication disorders is designed to prepare students for academic careers and for positions as researchers in speech and hearing-science laboratories.

The department requires a research tool. It is up to the student's Guidance Committee to require the specific competencies deemed appropriate to the candidate's research. For example, students doing experimental research probably need advanced work in statistics or computer science; students doing historical-critical research in classical rhetoric probably need a reading-knowledge of more than one language.

Graduate study leading to the M.F.A. emphasizes the production aspect of theatre, and students concentrate in either acting-directing or design-technical work.

Candidates for the M.A. degree should select one of the following major areas of concentration: (1) communication disorders (speech and hearing sciences), (2) mass communications, (3) rhetoric and public address, (4) theatre and oral interpretation, or (5) speech education.

Graduate study leading to the M.A. in communication disorders is designed to prepare students for careers as speech pathologists or audiologists or for doctoral study in these fields. Graduate work leading to an M.A. in mass communications provides the student with academic background for entering the communications industries in either educational or commercial media, and provides a foundation for doctoral study. The M.A. in rhetoric-public address and theatre-oral interpretation emphasizes theoretical

cal, historical, and critical studies of these subjects and is designed primarily to prepare students for doctoral study and for careers in college and university teaching and research. (Negotiations are under way for Theatre to move from the faculty of Social and Behavioral Sciences into the Humanities and Fine Arts faculty. Interested students should write directly to the Theatre Chairman for current information.) Graduate work leading to the M.A. in speech education is a more general course of study to prepare candidates for secondary school teaching of public speaking, oral interpretation, debate, theatre and mass communication.

Applicants to the graduate program should meet all requirements for admission to the Graduate School and either have a good undergraduate background in speech or proceed to correct deficiencies without graduate credit.

The M.A. degree is offered under thesis and non-thesis option. Candidates must complete a minimum of 30 credits for both options. The thesis option allows up to 6 credits for the thesis. The M.F.A. candidate must complete 60 credits. A minimum of 60 credits beyond the bachelor's degree, exclusive of credits for dissertations is required for the Ph.D. Plans of study are prepared individually in consultation with faculty advisers.

ALL COURSES CARRY 3 CREDITS UNLESS OTHERWISE SPECIFIED

COURSES OPEN TO GRADUATE STUDENTS ONLY

(For either major or minor credit)

700. SPECIAL PROBLEMS.

Independent study in special subjects. No more than 9 credits may be applied toward the M.A. degree.

Credit, 1-3 each semester; maximum credit, 9.

707. SEMINAR IN MASS COMMUNICATIONS.

Revolving topics in mass communications; research papers, reports. Course may be repeated for credit; credit not granted for the same topic twice.

Prerequisite, 9 upper-division hours in mass communications and permission of instructor.

711. RHETORICAL CRITICISM.

Selected theories and methods of rhetorical criticism and their applications.

Prerequisites, Speech 205/505 and one other course in rhetorical theory. Mr. Stelzner.

712. RHETORIC OF ARISTOTLE.

Intensive study of the *Rhetoric* in translation; related concepts in other works of Aristotle. Lectures, discussion, papers. Mr. Wallace.

713. THEORIES OF LANGUAGE AND STYLE.

Theories of language and style from ancient times to the present. Emphasis on their application to rhetorical theory and criticism.

Prerequisite, 12 credits in rhetoric. Miss Blankenship.

714. EXPERIMENTAL STUDIES IN PERSUASION THEORY.

Examination of quantitative research studies in persuasion. Attention to experimental research.

Prerequisites, Speech 211/511 and 350/650. Mr. Cronen.

715. DIRECTING THE FORENSIC PROGRAM.

Problems related to forensic programs: coaching individual and group activities, judging, tournament adminis-

tration, and administration of the entire forensics program.

Prerequisite, permission of instructor. Mr. Matlon.

718. SEMINAR IN PUBLIC ADDRESS.

Selected topics in the history and criticism of public address.

Prerequisite, permission of instructor. May repeat for a total of 6 credits. Mr. Reid, Mr. Sillars.

719. SEMINAR IN RHETORICAL THEORY.

Selected topics in rhetorical theory; detailed consideration of the relationship of rhetoric to other disciplines, specific concepts, periods, and figures.

Prerequisite, permission of instructor. May repeat for a total of 6 credits.

720. SEMINAR IN MEDIA RESEARCH METHODS.

Historical, descriptive, critical, experimental, and quantitative mass communications research methodologies.

Prerequisite, 9 upper-division hours in mass communications and permission of instructor. May repeat for a total of 6 credits.

721. SEMINAR IN BROADCASTING.

Revolving topics pertaining to various political, social, and economic aspects of broadcasting; research papers, reports.

Prerequisite, 9 upper-division hours in mass communications and permission of instructor. Course may be repeated for credit, but students may not receive credit for the same topic twice.

722. SEMINAR IN FILM.

Intensive study of topics in film history, theory, and criticism. Revolving topics.

Prerequisite, 9 upper-division hours in mass communications and permission of instructor. Course may be repeated; credit not granted for the same topic twice.

733. MASS PERSUASION.

The process, functions, and effects of persuasion on a mass level. The role of the mass media. Mr. Bohn.

734. FILM AND SOCIETY: THE CINEMA AS A SOCIAL FORCE.

The effective and reflective roles of film in society. Emphasis on the relationship of society to the structure, development, function, and effects of the motion picture.

Mr. Bohn.

741. ADVANCED SCENE DESIGN.

Special problems in conceiving the visual elements of theatre. Experimental design and design for atypical theatre structures emphasized.

Prerequisite, Speech 241/541 or equivalent. Mr. Fiala.

742. HISTORY OF THEATRICAL COSTUME I.

Period costumes from primitive man to the 17th century; projects in design from a number of these periods. Prerequisite, Speech 242/542 or equivalent.

743. HISTORY OF THEATRICAL COSTUME II.

Period costume from the 17th century to the present; projects in design from a number of these periods. Prerequisite, Speech 242/542 or equivalent.

744. ADVANCED ACTING.

Investigation of an experimentation with various actor-character relationships.

Prerequisite, Speech 244/544 or equivalent. Mr. Young.

745. ADVANCED DIRECTING.

Various styles of staging period and contemporary dramas; examination of these styles within their historical contexts.

Prerequisite, Speech 246/546 or equivalent. Mr. Young.

747. TOPICS IN THEATRE HISTORY.

Detailed study of selected eras in the development of theatre.

748. TOPICS IN CONTEMPORARY THEATRE.

Distinctive 20th-century theatrical concepts in Europe and the United States.

756. THEATRE MANAGEMENT.

Modern theatrical-production organization, economics, special contractual problems, and administration.

757. ADVANCED STAGE LIGHTING.

Aesthetics of stage lighting and the problems and practices of the lighting designer. Emphasis on the lighting of selected plays.

Prerequisite, Speech 257/557 or equivalent.

758. THEATRE PRACTICUM.

Conception and execution of two creative theatrical assignments selected with and supervised by the student's adviser. The number of hours depends upon the projects which a student and his adviser establish. Typically, the sequence would be three hours credit for each of the M.F.A. candidate's first two semesters.

Credit, 1-6.

761. CONTEMPORARY DRAMATIC THEORY AND CRITICISM.

An examination of important theories of dramatic art from 1900 to the present.

Prerequisite, Speech 261/561 or equivalent.

Mr. Stewart.

763. THEATRE AND RITUAL.

Relationship of ritual and theatre from primitive man to Genet.

Mr. Young.

765. THE RHETORIC OF THEATRE.

Theories of rhetoric and poetic as relevant to drama and (of specific approaches) to the rhetorical criticism of plays.

Mr. Stewart.

770. HISTORY OF SPEECH EDUCATION.

Speech pedagogy from ancient Greece to the present. Emphasis on speech education in America.

Mr. Brown.

771. SEMINAR IN SPEECH PEDAGOGY.

Selected topics relevant to the principles and methods of teaching speech. Attention to rhetoric and theatre.

Mr. Brown, Mr. Price.

781. VOICE PROBLEMS.

Voice disorders, organic and functional; symptoms, and principles and techniques of therapy and diagnosis.

Prerequisites, Speech 182 and 284 or equivalents.

Mr. Peirce.

782. ADVANCED CLINICAL PRACTICE.

Supervised clinical practice with children and adults with various speech and hearing disorders; group and individual therapy techniques.

Prerequisites, Speech 181, 182 and 284 or equivalents.

Credits, 1-6.

783. INTRODUCTION TO EXPERIMENTAL PHONETICS.

Review of experimental research and instrumental approaches in the study and analysis of the phonetic elements of language. Individual student reports.

Prerequisites, Speech 181, 284, or equivalents.

Mr. Nerbonne.

784. ORGANIC PATHOLOGIES OF SPEECH.

Etiology, classification, evaluation, and speech rehabilitation of cleft palate, laryngectomy, and other organic pathologies of speech.

Prerequisites, Speech 283 and 284.

785. NEUROPATHOLOGIES IN COMMUNICATION DISORDERS I.

Principles concerning etiologies, instruments for evalua-

tion, classification, and methods of clinical management of acquired aphasia and cerebral palsy.

Prerequisites, Speech 284 and 289/589.

786. NEUROPATHOLOGIES IN COMMUNICATION DISORDERS II.

Delayed development of speech and language in the mentally retarded and perceptually handicapped; evaluation, classification, and habilitation.

Prerequisite, Speech 289/589.

787. HEARING CONSERVATION AND INDUSTRIAL AUDIOLOGY.

Identification and management of the hearing-impaired in hospitals, public schools, and industry. Noise control and other preventative measures.

Prerequisite, Speech 285.

Mr. Tokay.

788. ADVANCED CLINICAL AUDIOLOGY.

Theories, methodologies, and procedures for special diagnostic testing in audiology. Hearing, selection and evaluation procedures.

Prerequisite, Speech 285/585.

Mr. Tokay.

789. TRENDS IN CONTEMPORARY AUDIOLOGY.

Investigation and evaluation of the recent research and advances in knowledge concerning the auditory capacities, and the management of audiological problems.

Prerequisite, Speech 788.

Mr. Nober.

790. BEHAVIOR MODIFICATION IN COMMUNICATION DISORDERS.

The habilitation and rehabilitation of speech and language disorders through behavior modification, using operant procedures.

Prerequisite, Speech 182 and 283.

791. MANAGEMENT OF COMMUNICATION DISORDERS PROGRAMS.

Investigation, management, and supervision of speech pathology and audiology programs in public schools, rehabilitation centers, hospital clinics, and in special-education residential settings.

Prerequisite, permission of instructor.

792. THEORIES OF HEARING.

The current acoustic, psychophysiological, physical, anatomical, psychological, and clinical aspects of audition, and the theories of hearing developed to explain them.

Prerequisite, Speech 284, 285/585, 287/587.

Mr. Tolhurst.

793. HEARING AIDS AND AMPLIFICATION.

The nature and types of amplifying systems employed with hearing-handicapped. Electro-acoustic characteristics including gain, power, acoustic response, distortion, etc. Principles and methods of selection and usage of hearing-aids.

Prerequisite, Speech 788.

Mr. Tokay.

800. MASTER'S THESIS

Credit, 3-6.

810. SEMINAR IN RESEARCH TOPICS AND METHODS.

Desirable areas and topics of investigation; application methodology and bibliography. Tentative exploration of selected subjects. Offered for doctoral students as needed, with sections arranged for each of the principal areas of the department.

812. SEMINAR IN CONTEMPORARY RHETORICAL PRACTICE AND CRITICISM.

Intensive study and analysis of the speaking and writing generated by a major public controversy, 1930 to the present.

Miss Blankenship, Mr. Sillars, and Mr. Stelzner.

900. DOCTORAL DISSERTATION.

Credit, 15.

COURSES OPEN TO BOTH GRADUATE AND UNDERGRADUATE STUDENTS

(For either major or minor credit)

505. CLASSICAL RHETORICAL THEORY.
Major rhetorical theories from their emergence in ancient Greece to the late Roman Empire. Emphasis on the Sophists, Plato, Aristotle, Hermagoras, Cicero, Quintilian, and St. Augustine.

506. EARLY MODERN RHETORICAL THEORY.
The impact of contemporaneous science, philosophy, and aesthetics on rhetorical theory from 1600 to 1900. Emphasis on the 18th-century rhetorical renaissance.
Prerequisite, Speech 205/505 or permission of instructor.
Mr. Bevilacqua.

507. RHETORIC AND SOCIAL CHANGE IN AMERICA.
A survey of the rhetorical strategies of various American social movements such as the American Revolution, the populist movement, and the civil rights movement.
Mr. Reid.

511. CONTEMPORARY RHETORICAL THEORY.
Contemporary philosophical approaches to rhetorical theory. Selected major contemporary theorists such as Weaver, Richards, Burke, Duncan, McLuhan, and Perelman.
Miss Blankenship.

525. HISTORY AND DEVELOPMENT OF THE MOTION PICTURE.
The motion picture as a social force and as a form of art. Interrelationship and analysis of form, technique, and social impact of film. Selected screenings of representative film styles and content.

527. FILM THEORY AND CRITICISM.
Basic theories of film communication; various film modes and structures. Development of bases for evaluation of films according to communicative and aesthetic values.
Prerequisite, Speech 225/525.
Mr. Stromgren.

528. MASS MEDIA IN SOCIETY.
Mass media as a major force in the American society. Emphasis on cultural, economic, political, and social effects.
Prerequisite, Speech 121.
Mr. Meyer.

532. BROADCASTING AND THE GOVERNMENT.
The role, function, and effect of regulation on broadcasting.
Prerequisite, Speech 121.
Mr. Shelby.

540. TECHNICAL PRODUCTION.
The materials and methods in construction for the stage.
Prerequisites, Speech 115 and 140.
Mr. Scott.

541. PRINCIPLES OF SCENE DESIGN.
Intensive study and application of scene design principles to a series of design projects. Practical experience through laboratory work in scene painting and decoration.
Prerequisites, Speech 115 and 140.
Mr. Fiala.

542. DESIGN AND CONSTRUCTION OF COSTUME.
Silhouette, draping, color, texture, drafting of patterns, construction, and the application of these basic principles to a series of design projects.
Prerequisites, Speech 115 and 140.

544. ACTING II.
Character analysis and development with attention to the interrelationship of characters.
Prerequisites, Speech 115 and 243.
Mr. Young.

546. DIRECTING II.
Problems in the interpretation and staging of various types of contemporary drama. Attention to rehearsal and performance procedures.
Prerequisite, Speech 245.
Mr. Mahnken.

547. THEATRE HISTORY I.
The history of theatre in western civilization from its beginnings to 1642; an investigation of the classical, medieval, and Renaissance theatres. Emphasis on the origins and development of drama, spectacle, theatre production, and theatre architecture.

548. THEATRE HISTORY II.
History of the theatre in western civilization. Emphasis on the 18th and 19th centuries, the Continental, English, American, and modern theatres.

550. SPEECH AND LANGUAGE THEORY.
The nature of speech and language, and the process involved in acquiring, understanding, and producing speech and language.
Prerequisite, permission of instructor.
Mr. Conville, Mr. Nober.

551. ORAL INTERPRETATION OF CHILDREN'S LITERATURE.
Selection and interpretation of literary materials for children.

552. ADVANCED ORAL INTERPRETATION OF LITERATURE.
Concentration on the philosophical and technical bases for reading the lyric poem, fiction, drama, and documentary materials.
Prerequisite, Speech 152.

553. CHILDREN'S DRAMA I.
Informal dramatics, without an audience, in classroom and recreation programs, serving children's need for creative outlets and furthering awareness, self-expression, self concepts, and social growth through imagination, pantomime, and improvised story dramatization.

554. CHILDREN'S DRAMA II.
Formal aspects of children's theatre, the selection and presentation, by adults or older young people, of suitable plays for the child audience.

557. STAGE AND TELEVISION LIGHTING.
Principles, practices, and equipment involved in stage and television lighting.
Prerequisites, Speech 115 and 140.

561. HISTORY OF DRAMATIC THEORY.
A survey of important trends and documents in the history of dramatic theory from Plato to 1900.
Prerequisite, Speech 260.
Mr. Stewart.

562. THE BLACK PRESENCE IN AMERICAN DRAMA.
Selected works by American white and black playwrights, from mid-19th century to the present. Emphasis on the image of the Negro as presented.
Miss Abramson.

564. HISTORY OF THE AMERICAN THEATRE AND DRAMA.
The history of the American theatre from its beginnings in the 18th century to the present. Concerned in each period with the drama itself, the building in which it is performed, scenic effects, and the contribution of actor and director.
Miss Abramson.

581. CLINICAL PROCEDURES.
Introduction to the clinical process in a Communication Disorders Clinic including personnel responsibilities, professional ethics, techniques of differential diagnosis, study of clinical forms and referrals. Supervised observations of diagnostic and therapy sessions. Laboratory training in clinical equipment.
Mr. Melrose.

582. DIFFERENTIAL DIAGNOSIS IN SPEECH AND HEARING DISORDERS.

Review, analysis, and demonstrations of the diagnostic procedures used in the assessment and evaluation of speech and language disorders.
Prerequisites, Speech 182 and 281/581. Mr. Melrose.

586. REHABILITATION OF THE ACOUSTICALLY HANDICAPPED.

Techniques of speech therapy, auditory training, and speech reading for hard-of-hearing children and adults; multi-sensory approach to language development. Laboratory practice under supervision.
Prerequisite, Speech 285. Mr. Tokay.

587. FUNDAMENTALS OF HEARING AND SPEECH SCIENCE.

Investigation of physiological, acoustical, and psychological correlates of speech production, transmission, and reception. Exercises in the application of laboratory methods.
Prerequisites, Speech 181 and 284. Mr. Nerbonne.

588. CLINICAL PRACTICE.

Supervised experience in therapy with individuals having articulatory-type disorders.
May be repeated once.
Prerequisites, Speech 181 and 182. Credit, 1-3.

589. COMMUNICATION PROBLEMS OF THE DEAF AND HARD-OF-HEARING.

The physical, psychological, social, and educational problems and needs of the hearing handicapped.
Prerequisite, Speech 250/550. Mr. Nober.

590. STUTTERING.

Major theories of the etiology, diagnosis, and clinical management of stuttering.
Prerequisite, Speech 289/589.

591. PEDIATRIC AUDIOLOGY.

Assessment and clinical management of infants and children with auditory disorders. Problems of differential diagnosis, screening techniques, conditioning procedures and electrophysiologic methods. Parental guidance and employment of amplification with children.
Prerequisites, Speech 285 and 286/586. Mr. Tokay.

592. LEARNING AND LANGUAGE DISABILITIES IN CHILDREN.

Learning disabilities associated with physical, psychological, and social etiologies. Problems of language development and cognitive disorders, remedial practices in reading and writing problems, and learning patterns of the culturally disadvantaged. Diagnostic assessment and educational processes outlined.
Mr. Nober.

650. BEHAVIORAL RESEARCH AND COMMUNICATION.

Introduction to research design and the practical problems in carrying out experimental and descriptive research in speech communication. Students pursue research projects either individually or in groups.
Prerequisite, 12 undergraduate credits in Speech. Mr. Cronen.

659. POLITICAL COMMUNICATION: MEDIA AND CAMPAIGNING.

Diffusion of persuasive political communications through standard and created media. Examination of campaign techniques (i.e., research on issues and themes, electorate polling, thematic media approaches, campaign strategies) in management and administration.

660. PLAYWRITING.

The problems of translating idea into dramatic action.
Prerequisite, permission of instructor. Miss Bednerik.

690. SEMINAR IN COMMUNICATION DISORDERS.

Special problems in the field of communication disorders. Choice of a) communication disorders and the teacher, b) communication disorders in geriatrics, c) communication disorders and medicine, d) the non-verbal child, e) electrophysiologic audiometry and f) speech audiometry.
Prerequisite, permission of instructor. Credit, 3-9.

691. SEMINAR IN MASS COMMUNICATIONS.

Analysis and discussion of major problems in the field of mass communications. Examination of current research.

May be repeated for a total of 6 credits.

Prerequisite, 9 hours in mass communications courses.

Mr. Lynch.

Statistics

(See Mathematics)

Veterinary and Animal Science

(See Animal Science)

Wildlife and Fisheries Biology

GRADUATE FACULTY

DONALD R. POGULSKE, *Head of Department of Forestry and Wildlife Management and Professor, B.S., University of Massachusetts, 1950; M.S., Virginia Polytechnic Institute, 1952; Ph.D., University of Missouri, 1956.*

CHARLES F. COLE, *Director of Graduate Studies in Fisheries and Professor of Fisheries Biology, B.A., Cornell, 1950; Ph.D., 1957.*

FREDERICK GREELEY, *Director of Graduate Studies in Wildlife and Associate Professor of Wildlife Biology, B.A., Kenyon College, 1941; M.S., Wisconsin, 1949; Ph.D., 1954.*

CARL A. CARLOZZI, *Associate Professor of Resource Planning.*

WENDELL E. DODGE, *Associate Professor of Wildlife Biology, B.A., New Hampshire, 1955; M.S., Massachusetts, 1958; Ph.D., 1967.*

JAMES E. JOHNSON, *Assistant Professor of Fisheries Biology, B.A., Purdue, 1962; M.S., Butler, 1965; Ph.D., Arizona State, 1969.*

JOSEPH S. LARSON, *Associate Professor of Wildlife Biology, B.S., Massachusetts, 1956; M.S., 1958; Ph.D., Virginia Polytechnic Institute, 1966.*

JAMES A. McCANN, *Associate Professor of Fisheries Biology, B.S., Massachusetts, 1956; M.S., Iowa State, 1958; Ph.D., 1960.*

ROGER J. REED, *Associate Professor of Fisheries Biology, B.S., Pittsburgh, 1951; M.S., 1953; Ph.D., 1956.*

THE DOCTOR OF PHILOSOPHY DEGREE PROGRAM IN WILDLIFE AND FISHERIES BIOLOGY

Students completing the master's degree at the University or elsewhere may be accepted into our doctoral program but are formally admitted to candidacy only after the completion of a successful written and oral preliminary comprehensive examination based on concepts in general biology, ecology, fisheries and wildlife biology, and such other areas as may be stipulated by the student's Guidance Committee. Selection of courses is done by the student and his Guidance Committee and usually extends into areas beyond biology, leading the student towards competency in independent research in either fisheries or wildlife biology. Candidates are required to demonstrate reading knowledge at the journal level in one foreign language. The degree normally requires three years of study beyond the master's degree.

THE MASTER OF SCIENCE DEGREE PROGRAM IN EITHER FISHERIES BIOLOGY OR WILDLIFE BIOLOGY

Students may be accepted into the master's degree program leading to a degree either in fisheries biology or in wildlife biology. Applicants normally come from undergraduate biological backgrounds or from applied biological areas such as fisheries or wildlife. Students with backgrounds in areas tangential to the field of resource conservation may apply with the understanding that deficiencies could extend their time in the program; normally, two years are required for the completion of the master's degree. Candidates normally write theses worth 10 hours of credit and are given a final oral examination upon its completion. Occasional wildlife biology students completing a degree without a thesis must pass both a written and an oral examination. Students completing a thesis must offer in addition a minimum of 20 graduate credits, at least 6 of which must be earned in 701-900 series courses. There is no language requirement for the master's degree.

GENERAL INFORMATION

The Forestry and Wildlife Management Department offers graduate work leading to the Master of Science degree either in wildlife or in fisheries biology and the Doctor of Philosophy in wildlife and fisheries biology. Staff and facilities are available for supporting research in upland and wetland avian biology, mammalian biology and management; and estuarine, anadromous, and warmwater fisheries research as well as in the broader areas of natural resource management. Graduate training is required for professional entrance into state, federal, and private employment in resource management and into teaching positions stressing applied ecological principles in both secondary and college-level programs. Most applicants come from biological backgrounds as undergraduates; occasional exceptions can be made, with the provision that deficiencies be made up. Applicants are encouraged to correspond with the Directors of Graduate Studies in the Department for answers to specific questions, but all application materials should be sent directly to the Grad-

uate School; scores from the Graduate Record Examination, including the Advanced Biology, must accompany all applications. The application must clearly indicate whether the candidate wishes to enter the wildlife biology or the fisheries biology degree program. Research support at both the master's and doctoral level is frequently available either from grants to individual faculty members or through support provided by the Cooperative Wildlife and Fishery Units; this latter support is provided by the Massachusetts Division of Fisheries and Game, the Massachusetts Division of Marine Fisheries, the United States Bureau of Sport Fisheries and Wildlife, and the Wildlife Management Institute. Undergraduates receiving wildlife or fisheries degrees from the University of Massachusetts are strongly urged to apply to other universities in order to vary their professional training.

ALL COURSES CARRY 3 CREDITS UNLESS OTHERWISE SPECIFIED

COURSES OPEN TO GRADUATE STUDENTS ONLY

(For either major or minor credit)

700. SPECIAL PROBLEMS IN WILDLIFE OR FISHERIES BIOLOGY.

Credit, 3 per semester; maximum credit, 6.

701, 702. SEMINAR IN WILDLIFE AND/OR FISHERIES BIOLOGY.

Review and discussion of the literature, including such subjects as population dynamics and manipulation, fish and game law and administration, Afro-Eurasian problems, influence of land-use, and Arctic environments.

Credit, 1-3 per semester; maximum credit, 6.

756. FISHERIES BIOMETRICS.

The statistical treatment of fisheries research problems, including studies on age and growth, food habits, population estimates, condition factors, and population dynamics.

Prerequisites, Fish Biol 565 and Stat 121 or permission of instructor. Mr. McCann.

757. ADVANCED FISHERIES MANAGEMENT.

Scientific basis for modern fisheries management, emphasizing coldwater fishes, anadromous species, large reservoir and river fisheries, and conflicts of interest with other water uses.

Prerequisites, Fish Biol 565 and 756, or permission of instructor.

758. ADVANCED WILDLIFE MANAGEMENT.

Interrelationships of wildlife and forestry, grazing, cultivation, pollution, and other uses of natural resources.

800. MASTER'S THESIS.

Credit, 6-10.

900. DOCTORAL DISSERTATION.

Credit, 30.

COURSES OPEN TO BOTH GRADUATE AND UNDERGRADUATE STUDENTS.

(For either major or minor credit)

561. PRINCIPLES OF WILDLIFE BIOLOGY.

Fundamental ecology and principles of wildlife management, with emphasis on population characteristics and responses.

Lecture only, for non-majors. *Credit, 2.* Mr. Greeley.
Lecture and laboratory, for majors.

Credit, 3. Mr. Greeley.

562. TECHNIQUES OF WILDLIFE BIOLOGY.

Methods of collecting and interpreting data in wildlife management, with emphasis on field and laboratory ex-

perience in census methods and criteria for determining sex, age, and other characteristics of wild birds and mammals.
Prerequisites, Stat 121 and Wild Biol 561 or permission of instructor. Mr. Larson.

563. MANAGEMENT OF WETLAND WILDLIFE.
The origin and distribution of wetlands in North America; identification and habitat requirements of wetland wildlife; public and private management of wetland environments.
Prerequisites, Wild Biol 561 or permission of instructor. Offered 1974-1975 and alternate years. Mr. Larson.

564. MANAGEMENT OF UPLAND WILDLIFE.
Life histories, identification, and habitat requirements of upland game birds, game mammals, and furbearers; management of upland habitats.
Offered 1973-1974 and alternate years. Mr. Greeley.

565. TECHNIQUES OF FISHERIES BIOLOGY.
Principles and techniques of fishery management, stressing population and growth dynamics, and field procedures.
Mr. Johnson.

567. LABORATORY IN PRINCIPLES OF FISHERY BIOLOGY.
Field techniques in fishery biology; operation and use of fishery research and management equipment. Laboratory analysis of field-collected data using automatic data processing; manuscript preparation.
Corequisite, Fish Biol 565.
One 4-hour laboratory. Credit, 1. Mr. Reed.

570. ECOLOGY OF FISHES.
Biological responses of fishes to the environment. Aspects of feeding, home range, breeding behavior, and other responses to the environment.
Prerequisites, Fish Biol 565 and Zool 602 or permission of instructor. Mr. Johnson.

572. INTRODUCTION TO MARINE FISHERIES.
Factors affecting world marine fisheries resources and development. Review of selected species of commercial importance and of selected world fisheries. Several overnight field trips requiring Saturday attendance by arrangement.
Prerequisites, Fish Biol 565 and Zool 600 or permission of instructor. Mr. Cole.

Zoology

GRADUATE FACULTY

HAROLD RAUCH, *Chairman of the Department of Zoology and Professor*, B.S., Queens College, 1944; M.S., Illinois, 1947; Ph.D., Brown, 1950.

LAWRENCE M. BARTLETT, *Professor*, B.S., Massachusetts, 1939; M.S., 1942; Ph.D., Cornell, 1949.

GEORGE H. DERSHAM, *Assistant Professor*, B.S., University of Colorado, 1963; M.S., 1967; Ph.D., University of Oregon, 1970.

MAC V. EDDS, *Professor*, B.A., Amherst, 1938; M.A., 1940; Ph.D., Yale, 1943.

D. CRAIG EDWARDS, *Assistant Professor*, B.S., Swarthmore, 1961; Ph.D., Chicago, 1965.

DONALD FAIRBAIRN, *Professor*, B.A., Queens University, Canada, 1938; Ph.D., Rochester, 1942.

BRONISLAW M. HONIGBERG, *Professor*, B.A., California at Berkeley, 1943; M.A., 1946; Ph.D., 1950.

MINDAUGAS S. KAULENAS, *Associate Professor*, B.S., University of London, 1961; Ph.D., 1964.

DAVID J. KLINGENER, *Associate Professor*, B.A., Swarthmore, 1959; M.S., Michigan, 1961; Ph.D., 1964.

JOSEPH G. KUNKEL, *Assistant Professor*, B.A., Columbia, 1964; Ph.D., Case Western Reserve University, 1968.

BRUCE R. LEVIN, *Associate Professor*, B.S., University of Michigan, 1963; M.S., 1964; Ph.D., 1967.

STUART D. LUDLAM, *Associate Professor*, B.A., Cornell, 1960; Ph.D., 1964.

ARTHUR P. MANGE, *Associate Professor*, B.S., Cornell, 1954; M.S., Wisconsin, 1958; Ph.D., 1963.

JOHN G. MONER, *Associate Professor*, B.A., Johns Hopkins, 1949; M.A., Princeton, 1951; Ph.D., 1953.

WILLIAM B. NUTTING, *Professor*, B.S., Massachusetts, 1940; M.S., 1948; Ph.D., Cornell, 1950.

W. BRIAN O'CONNOR, *Assistant Professor*, B.S., St. Michael's, 1962; M.S., Purdue, 1966; Ph.D., 1967.

HERBERT E. POTSWALD, *Assistant Professor*, B.A., University of Minnesota, 1959; Ph.D., University of Washington, 1964.

JOHN L. ROBERTS, *Professor*, B.S., Wisconsin, 1947; M.S., 1948; Ph.D., California at Los Angeles, 1952.

LARRY S. ROBERTS, *Director of Graduate Studies in Zoology and Associate Professor*, B.S., Southern Methodist University, 1956; M.S., Illinois, 1958; D.S., Johns Hopkins, 1961.

H. DUNCAN ROLLASON, JR., *Professor*, B.A., Middlebury, 1939; M.A., Williams, 1941; M.A., Harvard, 1943; Ph.D., 1949.

THEODORE D. SARGENT, *Associate Professor*, B.S., Massachusetts, 1958; M.S., Wisconsin, 1960; Ph.D., 1963.

DENNIS G. SEARCY, *Assistant Professor*, B.S., Oregon State, 1964; Ph.D., California at Los Angeles, 1968.

JAMES G. SNEDECOR, *Professor*, B.S., Iowa State, 1939; Ph.D., Indiana University, 1947.

DANA P. SNYDER, *Associate Professor*, B.S., Illinois, 1947; M.S., 1948; Ph.D., Michigan, 1951.

ALASTAIR M. STUART, *Professor*, B.S., University of Glasgow, 1953; Ph.D., Harvard, 1961.

GORDON A. WYSE, *Assistant Professor*, B.S., Swarthmore, 1961; M.S., University of Michigan, 1963; Ph.D., 1967.

The Zoology Department offers graduate work leading to the Master of Arts, Master of Science, and Doctor of Philosophy degrees. Facilities are available for advanced study in the major fields of zoology including genetics, cytology, physiology and biochemistry, vertebrate and invertebrate zoology, limnology, ecology and behavior, developmental biology, and parasitology. Graduate training prepares students for university teaching and research, federal and state positions in the biological fields, research positions with industrial and pharmaceutical and biomedical institutions, and high school and junior college teaching.

Requests for application forms as well as for information pertaining to the graduate program should be directed to the Zoology Department.

Advanced Degrees.

Applications are accepted from students who have demonstrated superior ability as undergraduates. Undergraduate preparation should include at least 20 hours in biology, preferably including courses in genetics, comparative anatomy, embryology, invertebrate zoology, and physiology, as well as courses in mathematics through elementary calculus, general physics, organic chemistry, and a foreign language (French, German, or Russian). Early in his graduate career, the graduate student must demonstrate his proficiency, by examination, in major areas of zoology.

Preparation for such examinations can be made by formal enrollment in appropriate courses or by independent study of recommended readings.

Since teaching experience is regarded as an important part of graduate training, all students are required to teach halftime for two semesters unless equivalent experience has been obtained previously at another university.

All graduate students must enroll in Zoology 850, Seminar. A minimum of 1 credit per year up to a total of 4 is required.

THE MASTER OF ARTS AND MASTER OF SCIENCE DEGREE PROGRAMS

One of three plans may be followed in fulfillment of the requirements for the master's degree:

A. The student may write a thesis based on original research. In addition to the thesis, the student must offer a minimum of 20 graduate credits, at least 6 of which must be earned in 701-900 series courses (excluding Zoology 800).

B. The student may undertake a program of original research, offering a total of 9 credits of Zoology 700, Special Problems, but not a thesis. In addition, 21 graduate credits must be offered, of which at least 6 must be earned in 701-900 series courses.

C. The student may offer 3 credits of Zoology 700, Special Problems, to be completed in one semester. Twenty-nine additional credits are required, and at least 12 of these credits must be earned in the 701-900 series (excluding Zoology 850, Seminar).

All candidates must pass the graduate reading examination at the intermediate level in one foreign language (ordinarily French, German, or Russian) and a final oral examination.

THE DOCTOR OF PHILOSOPHY DEGREE PROGRAM

A student is formally admitted as a candidate for the doctorate when he has demonstrated general proficiency as previously described and has successfully completed an oral preliminary examination based on advanced concepts in one major and two minor areas selected from the following: genetics, developmental biology, cytology, cell physiology and biochemistry, ecology, behavior, physiology, parasitology, systematics, and evolution.

With the consent of his Guidance Committee and the approval of the Department Graduate Affairs Committee, he may substitute equivalent work in another department as one minor area. Selection of

courses is not restricted to the subjects to be presented for examination. All students must complete the departmental language requirement before taking the oral preliminary examination. This requirement is 1) reading proficiency at the intermediate level in two foreign languages, or 2) reading proficiency at the advanced level in one foreign language. Foreign students whose native language is not English are required to demonstrate reading proficiency at the intermediate level in one foreign language. Foreign languages are usually selected from French, German, or Russian.

ALL COURSES CARRY 3 CREDITS UNLESS OTHERWISE SPECIFIED

COURSES OPEN TO GRADUATE STUDENTS ONLY

(For either major or minor credit)

700. SPECIAL PROBLEMS. Credit, 1-9.

702. GENERAL CYTOLOGY.
The morphological features of cells in relation to their function. Lectures, seminar reports and individual laboratory work.
Offered spring semester.
Prerequisite, Zool 523.

708. ELECTRON MICROSCOPY.
Lectures and laboratory on the electron microscope and methods of specimen preparation.
Offered fall semester.
Prerequisite, permission of instructor.

710. FINE STRUCTURE AND FUNCTION OF CELLS.
Lectures, discussions, reading, and reports on fine structure of cells and dynamic morphology.
Offered spring semester.
Prerequisites, Zool 523, 660.

720. EXPERIMENTAL EMBRYOLOGY.
Lectures and discussions on the causal analysis of animal development. Laboratory on *in vivo* and *in vitro* culture methods.
Offered fall semester.
Prerequisites, Zool 680 or 527.

724. ADVANCED DEVELOPMENTAL BIOLOGY.
Molecular basis of cell and tissue differentiation. Emphasis on gene action, synthesis and function of macromolecules, and hormonal control of developmental processes.
Offered spring semester.
Prerequisites, Biochem 523 or Zool 660; Zool 540.
Mr. Kaulenas.

730. PHYSIOLOGICAL GENETICS.
The nature of the gene and its action in the developmental and physiological processes of the organism.
Offered spring semester.
Prerequisites, Zool 540 and permission of instructor.
Mr. Rauch.

740. ADVANCED INVERTEBRATE ZOOLOGY.
Continuation of Zoology 582. Emphasis on development.
Offered spring semester.
Prerequisite, Zool 582. Mr. Potswald.

744. METAZOAN SYMBIOSIS.
Host-symbiont relationships of mutuals, commensals, and parasites. Systematics, morphology, life histories, and physiology of metazoan symbionts of animals. Laboratory on research techniques.
Offered fall semester.

Prerequisites, a course in invertebrate zoology or parasitology; permission of instructor. Mr. L. S. Roberts.

750. SELECTED TOPICS IN ANIMAL BEHAVIOR. Topics selected from active areas of current research (e.g., communication, development, systems analysis, sociobiology) with an emphasis on critical analyses of theory and methodology.

Three hours lecture-discussion-reports.

Offered spring semester.

Prerequisite, Zool 650.

Credit, 3 per semester. Mr. Sargent, Mr. Stuart.

751. BIOLOGY OF ANIMAL POPULATIONS.

Organization and process in the local population. The viewpoint is holistic, emphasizing the population as an integrated functional unit of life. Extensive student participation in discussion and presentation of critiques of current concepts.

Offered fall semester.

Prerequisites, Zool 757 and either 546, 650, or 755; or equivalent background; permission of instructor.

Mr. Snyder.

755. SYSTEMATICS AND EVOLUTIONARY

MECHANISMS.

A theoretical consideration of evolution and systematics at and above the species level.

Offered fall semester.

Prerequisite, Zool 540.

Mr. Klingener.

757. POPULATION AND COMMUNITY ECOLOGY.

Distribution patterns of organisms, population growth and regulation, interspecific competition and other population interactions, and community structure and energetics. Sampling methods, use of models, individual and group projects in the laboratory.

Two hours lecture-discussion, one laboratory.

Offered spring semester.

Prerequisites, one course each in ecology, invertebrate zoology, Math 124; statistics desirable.

Mr. Edwards.

770. COMPARATIVE NEUROPHYSIOLOGY.

Sensory and nervous function in invertebrates and vertebrates. Emphasis on integrative mechanisms underlying animal behavior.

Offered fall semester.

Prerequisites, a year of chemistry and physics, and cell physiology or physiological psychology; or permission of instructor.

Credit, 3. Mr. Wyse.

780. PHYSIOLOGICAL REGULATORY

MECHANISMS.

Physiological regulation and its basis in cells and organisms.

Prerequisite, Zool 660 or equivalent.

Credit, 2-4 per semester. Mr. J. L. Roberts, Mr. Moner.

784. ENDOCRINOLOGY.

The importance of the endocrines in their control over normal functions (growth, metabolism, reproduction, etc.) in a variety of animals.

Two class hours, one 3-hour laboratory period.

Offered spring semester.

Prerequisite, Zool 666.

Mr. Snedecor.

790. WRITING FOR THE LIFE SCIENCES.

Principles and techniques of scientific writing for students in the life sciences whose researches are well advanced.

Offered spring semester.

Prerequisite, permission of instructor.

Mr. Fairbairn.

810. TOPICS IN ZOOLOGY.

One or more topics of special or current interest covered in lectures and discussion. *Credit, 1-6 per semester.*

850. SEMINAR.

Each semester a topic from each of the following areas is chosen for discussion: cytology, genetics, and develop-

mental biology; physiology and biochemistry; environmental and systematic biology. *Credit, 1 each semester.*

800. MASTER'S THESIS.

Credit, 10.

900. DOCTORAL DISSERTATION.

Credit, 15.

COURSES OPEN TO BOTH GRADUATE AND UNDERGRADUATE STUDENTS

(For either major or minor credit)

521. COMPARATIVE VERTEBRATE ANATOMY.

Structure and phylogeny of vertebrates. Laboratory work illustrating evolutionary trends and specializations. Experience in dissection.

Two class hours, one 3-hour laboratory period.

Prerequisite, Zool 101 or 540.

Mr. Klingener, Mr. Snyder.

523. HISTOLOGY.

Structure of cells, tissues and organs as related to function, with emphasis on the mammal; introduction to microtechnique.

Two class hours, one 3-hour laboratory period.

Prerequisite, Zool 101 or 540.

Mr. Potswald, Mrs. Rollason.

527. EMBRYOLOGY.

A survey of embryonic development from a combined descriptive, comparative, and analytical point of view. Laboratories deal with descriptive and comparative phases of ontogeny, especially of amphibians, birds, and mammals.

Offered spring semester.

Two class hours, one 3-hour laboratory period.

Prerequisite, Zool 101 or 540.

530. SYSTEMS OF THE HUMAN BODY.

Lectures on human anatomy and physiology, based on an integrated discussion of systems of the body. Laboratories emphasize the functional properties of the human organism; supplemental exercises in gross anatomy of the cat and rat. For students in Medical Technology and Public Health. A limited number of students in the engineering and physical science fields allowed by permission of instructor.

Three class hours, one 3-hour laboratory period.

Offered spring semester.

Prerequisites, Chem 111, 112; Zool 101, 223 (or 223 concurrently).

Credit, 4. Mr. O'Connor.

540. PRINCIPLES OF GENETICS.

Mechanisms of heredity in plants and animals, emphasizing transmission and action of genes, population genetics, and evolution.

Prerequisites, Chem 111 and one semester of biological science. Mr. Levin, Mr. Mange, Mr. Scudo, Mr. Rauch.

546. POPULATION GENETICS.

The causes of evolution, emphasizing genetical, ecological, and behavioral aspects. Some problems approached through mathematical models, stressing their biological implications.

Offered fall semester.

Prerequisites, Zool 540 and Math 123 or 135; and permission of instructor.

Mr. Mange, Mr. Scudo.

575. BIOLOGY OF PROTOZOA.

Morphology and physiology of Protozoa; the contributions made to basic problems of biology through studies of these organisms. Lectures, readings, laboratory demonstrations and exercises. Exact format varies from year to year. Total, 5 hours lecture and laboratories.

Offered spring semester.

Prerequisites, Chem 262 and 264.

Mr. Honigberg.

581. BIOLOGY OF LOWER INVERTEBRATES.

Survey of invertebrate animals based on evolutionary and phylogenetic considerations. Includes the Protozoa,

Porifera, Cnidaria, Platyhelminthes, Nematoda, Mollusca, etc.

Two class hours, one 3-hour laboratory.

Offered spring semester.

Prerequisites, Zool 101 or 540.

Mr. Nutting, Mr. L. S. Roberts.

582. BIOLOGY OF HIGHER INVERTEBRATES.

Survey of invertebrate animals based on evolutionary and phylogenetic considerations. Includes the Annelida, Arthropoda, Ectoprocta, Echinodermata, etc.

Two class hours, one 3-hour laboratory.

Offered fall semester.

Prerequisites, Zool 101 or 540.

Mr. Nutting, Mr. L. S. Roberts.

583. GENERAL PARASITOLOGY.

Morphology, life cycles, and physiology of protozoan and helminth parasites. Emphasis on broad aspects of parasitism.

Two class hours, one 3-hour laboratory period.

Offered fall semester.

Prerequisites, Zool 101 or 540; Chem 112 or 114.

Mr. Honigberg.

600. VERTEBRATE ZOOLOGY.

History, relationships, patterns of distribution, classification of vertebrates with emphasis on fishes.

One class hour, two 2-hour laboratory periods, field trips.

Offered fall semester.

Prerequisite, Zool 101 or 540.

Mr. Andrews.

602. ICHTHYOLOGY.

Morphology, ecology, and relationships of fishes, and their distribution in space and time.

Two class hours, one 3-hour laboratory period.

Offered spring semester.

Prerequisite, Zool 521 or 600.

Mr. Andrews.

606. ORNITHOLOGY.

Avian biology including structural and functional adaptations; emphasis on behavioral patterns. Laboratory includes field trips.

Two class hours, one 3-hour laboratory period.

Offered spring semester.

Prerequisite, Zool 101 or 540. Mr. Bartlett, Mr. Sargent.

608. MAMMALOLOGY.

Evolution, distribution, classification, and ecology of mammals. Laboratory includes field trips, preparation of study material, and identification of local fauna.

Two class hours, one 3-hour laboratory period.

Offered spring semester.

Prerequisites, Zool 521 or 600.

Mr. Snyder.

635. LIMNOLOGY.

The physical, chemical, and biological aspects of inland waters.

Two class hours, one 3-hour laboratory or field trip.

Offered spring semester.

Prerequisites, Bot 100, Zool 101, Chem 112, and Phys 103. Mr. Ludlam.

637. ECOLOGY.

Introduction to ecosystems, the structure and function of natural communities, and populational biology. Field trips and laboratory experiments.

Two class hours, one 3-hour laboratory period, or field trips.

Offered fall semester.

Prerequisites, Zool 101 or 540, Math 124, and one semester of invertebrate zoology, preferably Zool 282.

Mr. Edwards.

650. ANIMAL BEHAVIOR.

The biological bases of animal behavior, with an analysis of the methods and objectives of current research.

Three class hours.

Offered fall semester.

Prerequisites, Zool 101 or 540 and Psych 101; or Psych 215; or permission of instructor. Mr. Sargent, Mr. Stuart.

660. CELL PHYSIOLOGY.

The structure and function of cells. Emphasis on membrane systems, including active transport, nucleic acid and protein synthesis, and the mechanisms involved in the control of cellular processes.

Two class hours, one 3-hour laboratory period.

Offered fall semester.

Prerequisites, one year of biology and Biochem 223 or equivalent.

Mr. Kaulenas, Mr. Kunkel, Mr. Moner, Mrs. Searcy.

666. VERTEBRATE PHYSIOLOGY.

Function of organs and organ systems in vertebrates.

Three class hours, one 3-hour laboratory period.

Offered fall semester.

Prerequisite, Zool 660 or Chem 520 or 523.

Mr. Snedecor.

670. COMPARATIVE PHYSIOLOGY.

Physiological principles involved in adaptations of animals to their environment; emphasis in the laboratory on experimental methods used to study adaptive mechanisms.

Three class hours, one 3-hour laboratory period.

Offered spring semester.

Prerequisite, Zool 660.

Mr. J. L. Roberts.

680. DEVELOPMENTAL BIOLOGY.

Lectures emphasize physiological and biochemical aspects of development. Laboratory period used for demonstrations, discussions, and literature reviews, as well as for experimental work.

Two class hours, one 3-hour laboratory period.

Prerequisite, Zool 660.

Mr. Kaulenas, Mr. Kunkel.

PARTIAL LIST OF COURSES IN OTHER DEPARTMENTS WHICH MAY BE TAKEN FOR MAJOR CREDIT

GRADUATE LEVEL COURSES

AN SCI 706. QUANTITATIVE INHERITANCE AND SELECTION.

AN SCI 724. ADVANCED AVIAN PHYSIOLOGY.

AN SCI 725. MAMMALIAN REPRODUCTION.

BOTANY 711, 712. ADVANCED PLANT PHYSIOLOGY.

BOTANY 721. ADVANCED PLANT ECOLOGY.

BIOCHEM 726. EXPERIMENTAL ENZYMOLOGY.

BIOCHEM 729. ENZYMES.

ENT 611. INSECT BEHAVIOR.

ENT 803. INSECT DEVELOPMENT.

ENT 814. ADVANCED ANIMAL ECOLOGY.

MICROBIOL 710. ADVANCED IMMUNOLOGY.

MICROBIOL 720. MAMMALIAN VIROLOGY.

MICROBIOL 770. MICROBIAL GENETICS.

UNDERGRADUATE LEVEL COURSES

AN SCI 621. PHYSIOLOGY OF REPRODUCTION.

BOTANY 521. PLANT ECOLOGY.

BOTANY 611. CYTOLOGY.

BIOCHEM 523, 524. GENERAL BIOCHEMISTRY.

CHEM 544. RADIOCHEMISTRY.

CHEM 581, 582. ELEMENTARY PHYSICAL CHEMISTRY.

GEOL 540. INVERTEBRATE PALEONTOLOGY.

MICROBIOL 550. GENERAL MICROBIOLOGY.

MICROBIOL 610. IMMUNOLOGY.

MICROBIOL 620. VIROLOGY.

PSYCH 550. PHYSIOLOGICAL PSYCHOLOGY.

Faculty Emeriti

AGRICULTURAL AND FOOD ECONOMICS

ELLSWORTH W. BELL, *Professor Emeritus of Agricultural and Food Economics* (1969).

FAYETTE HINDS BRANCH, *Extension Professor Emeritus of Agricultural Economics and Farm Management*.

ADRIAN HERVE LINDSEY, *Professor Emeritus of Agricultural Economics and Head Emeritus of Department of Agricultural Economics and Farm Management*.

DAVID ROZMAN, *Research Professor Emeritus of Agricultural and Food Economics*.

RUTH EVELYN SHERBURNE, *Instructor Emeritus in Agricultural and Food Economics*.

ANIMAL SCIENCE

LUTHER BANTA, *Professor Emeritus of Animal Science* (1959).

KENNETH BULLIS, *Professor Emeritus of Animal Science* (1961).

FRED P. JEFFREY, *Professor Emeritus of Animal Science* (1971).

WILLIAM SANCTUARY, *Professor Emeritus of Animal Science* (1958).

HENRY VAN ROEKEL, *Professor Emeritus of Animal Science* (1965).

BUSINESS ADMINISTRATION

HAROLD E. HARDY, *Professor Emeritus of Marketing*.
HENRY BENJAMIN KERSHIN, *Dean Emeritus of School of Business Administration*.

RUDOLF HAROLD KIZLER, *Associate Professor Emeritus of Business Administration*.

HAROLD WILLIAM SMART, *Associate Professor Emeritus of Business Law*.

CHEMICAL ENGINEERING.

HANS C. DUUS, *Professor Emeritus of Chemical Engineering*.

CHEMISTRY

EMMETT BENNETT, *Professor Emeritus of Chemistry*.

CHARLES ADAMS PETERS, *Professor Emeritus of Chemistry*.

ELECTRICAL ENGINEERING

JOSEPH W. LANGFORD, *Professor Emeritus of Electrical Engineering* (1972).

ENTOMOLOGY

CHARLES P. ALEXANDER, *Professor Emeritus of Entomology* (1959).

FRANK R. SHAW, *Professor Emeritus of Entomology* (1970).

MARION E. SMITH, *Associate Professor Emeritus of Entomology* (1971).

HARVEY L. SWEETMAN, *Professor Emeritus of Entomology* (1966).

ELLSWORTH H. WHEELER, *Professor Emeritus of Entomology* (1969).

FOOD AND AGRICULTURAL ENGINEERING

GERALD A. FITZGERALD, *Professor Emeritus of Food and Agricultural Engineering* (1970).

FOOD SCIENCE AND TECHNOLOGY

ARTHUR S. LEVINE, *Professor Emeritus of Food Science and Technology* (1968).

FORESTRY AND WOOD TECHNOLOGY

ROBERT POWELL HOLDSWORTH, *Professor Emeritus of Forestry* (1958).

J. HARRY RICH, *Professor Emeritus of Forestry* (1958).

FRENCH

STOWELL C. CODING, *Professor Emeritus of French*.

GERMANIC LANGUAGES AND LITERATURES

FREDERICK C. ELLERT, *Professor Emeritus of Germanic Languages and Literatures* (1970).

HISTORY

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1972-1973

Medical School Catalogue

University of Massachusetts
at Worcester

A scenic photograph of a lake, likely Lake Quabbin, with several sailboats on the water. The foreground is dominated by the dark, silvery-barked branches of a tree, possibly a weeping willow, which frame the view. The water is a deep blue-green, and the background shows a line of green trees and some buildings under a clear sky.

*1972-1973
Catalogue of the
Medical School*

University of Massachusetts at Worcester

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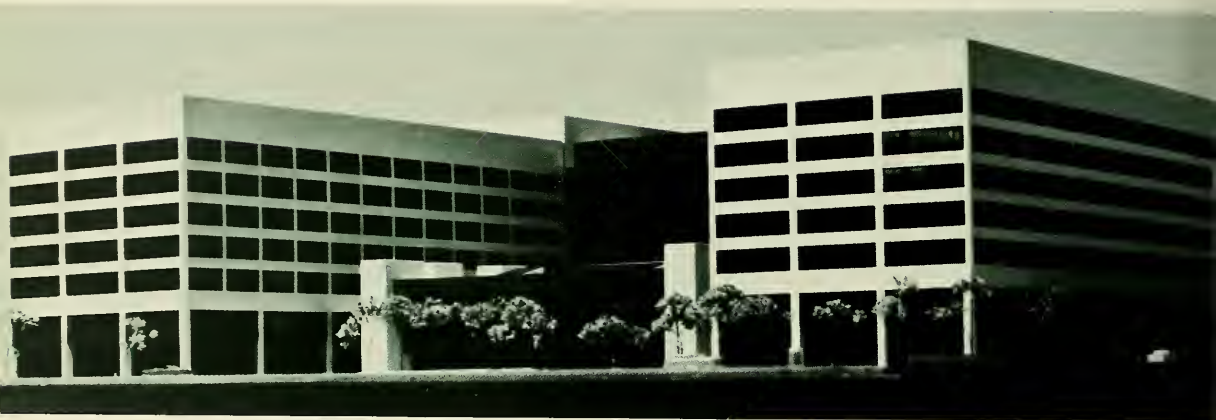
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Foreword



AS THE SCHOOL YEAR 1972-73 opens, our student body numbers 64, and our faculty, including volunteers, over 100. Our first class will have its first clinical year in the hospitals in Worcester. Staffing for all departments will increase, and the School will move another step towards its completion. Construction of the medical science building, the power plant, and the 400-bed teaching hospital is proceeding well. We will occupy the science building in the summer of 1973, and will start to use the power plant at that time.

The intimacy of the relations between students and faculty continues to be very good. The preservation of this beneficial relationship will be a matter of primary concern as the School enlarges. It will also be important to continue and develop our relations in the community—with hospitals, physicians, men in public office, and the many citizens who have supported us so well. We have benefited by their support in obtaining our hospital, in the development of clinical teaching, largely done by dedicated volunteers, and in many other ways. We are helping them with support of hospital training programs, of programs in community medicine and other ways. One of these last is the service of our library to the physicians and hospitals of Worcester County. During the next year the collection of the Worcester Medical Library, an illustrious institution which can boast of being the third oldest in the country, will be intershelved with our own in our new library and it will merge with us, getting full use of our services but retaining title to its own books.

The past year has been one of steady progress. We look forward to further advances in the coming year.

LAMAR SOUTTER, M.D.
Dean

1972-73 Academic Calendar

Monday, September 11	<i>Registration for first- and second-year students First day of second-year classes</i>
Tuesday, September 12	<i>First day of first-year classes</i>
Monday, September 18	<i>Registration and first day of third-year classes</i>
Monday, October 9	<i>Holiday</i>
Monday, October 23	<i>Holiday</i>
Wednesday, November 22	<i>Thanksgiving recess begins after last class</i>
Monday, November 27	<i>Thanksgiving recess ends, 8:00 A.M.</i>
Saturday, December 16	<i>Christmas recess begins after last class</i>
Tuesday, January 2	<i>Christmas recess ends, 8:00 A.M.</i>
Monday, February 19	<i>Holiday</i>
Friday, March 9	<i>Spring recess for first- and second-year students begins after last class</i>
Monday, March 19	<i>Spring recess for first- and second-year students ends, 8:00 A.M.</i>
Saturday, March 24	<i>Spring recess for third-year students begins after last class</i>
Monday, April 2	<i>Spring recess for third-year students ends, 8:00 A.M.</i>
Monday, April 16	<i>Holiday</i>
Monday–Friday, May 7–11	<i>Review and examinations (first-year class)</i>
Monday, May 28	<i>Holiday</i>
Friday, June 1	<i>Last day of second-year classes</i>
Friday, June 15	<i>Last day of first-year classes</i>
Saturday, June 23	<i>Last day of third-year classes</i>



General Information

The University System

THE UNIVERSITY OF MASSACHUSETTS is the state university of the Commonwealth, founded in 1863 under provisions of the Morrill Land Grant Act passed by the United States Congress one year earlier.

The University is a member of the great community of Land Grant colleges and state universities serving the nation as principal resources of higher education. Incorporated as the Massachusetts Agricultural College in April, 1863, the institution was opened to a handful of students in 1867. Rooted in the liberal arts tradition (its early presidents were graduates of such colleges as Dartmouth, Williams, Amherst, and Harvard), it has grown steadily from the four teachers and four wooden buildings available for its opening session. Reflecting the broadening interests of its students, the General Court of the Commonwealth of Massachusetts in 1931 authorized a second name, Massachusetts State College. Sixteen years later, in 1947, the institution became the University of Massachusetts.

The Amherst campus of the University consists of approximately 1,100 acres of land and 150 buildings, and enrollment there is approximately 20,000. A second campus was opened in 1965 in Boston, where enrollment is approximately 5,000. The Medical School at Worcester is the third campus of the University and the tenth division to offer programs of study leading to advanced degrees.

The Medical School

THE MEDICAL SCHOOL was authorized by an act of the legislature in 1962. In 1965 the decision was made to locate the School in Worcester. Subsequently, 126 acres of land on the eastern edge of the city, overlooking Lake Quinsigamond, were obtained for the School. In addition to providing a splendid site for the construction of new buildings, the property included an existing building containing some 48,000 square feet of floor space.

That structure, known as the Shaw Building, is the home of the School during the period of new construction. Limitation of space in the Shaw Building has necessitated limiting enrollment in the first few classes. Sixteen students were admitted to the first class in September, 1970, and classes of 24 students each were admitted in 1971 and 1972. Extensive renovation of the building was completed in 1971, providing accommodations for students and for the faculty of the basic science departments.

The first floor of the building contains two multi-discipline student laboratories and a separate laboratory for gross anatomy. Also on this floor

are the Library, a large room serving as both a lounge and eating area, faculty laboratories, several offices, student locker space, a mail room, animal quarters and a special room for two electron microscopes. The second floor contains two lecture rooms and faculty offices, including the Dean's Office and the Office of Admissions.

Affiliated Hospitals

HOSPITALS IN WORCESTER, and elsewhere in the state, have indicated interest in establishing a formal relationship with the Medical School. Affiliation agreements have been signed by St. Vincent Hospital (600 beds), Worcester City Hospital (448 beds), Worcester Memorial Hospital (379 beds), and Worcester Hahnemann Hospital (220 beds). Discussions are being held with the staffs of other hospitals outside of Worcester, and current plans are that the teaching of obstetrics and gynecology in the third year of the curriculum will be done at the Wesson Women's Hospital in Springfield. Similar plans call for participation by the Worcester State Hospital in the teaching of psychiatry.

The affiliation agreements are sufficiently flexible to permit various degrees of affiliation between the clinical departments of the School and the corresponding services of the hospitals. In this way, the academic needs of students can be met without compromising the primary commitment of the hospitals to patient care and without disturbing the relationship between physicians and their private patients. Appointments to the faculty of the Medical School of those members of various hospital staffs who are interested in teaching are being made upon recommendation of the departmental chairman and approval by the faculty and Trustees of the University.

In addition to hospitals having formal affiliation with the School, some 14 others contribute in a significant way to the implementation of the course in pathology during the second year.

New Facilities

ALL OF THE INITIAL group of new buildings for the Medical School are now under construction. The new basic and clinical science building contains the Library, teaching and research laboratories and lecture halls. Other buildings are the teaching hospital and the power plant. It is anticipated that the class entering in September of 1973 will be admitted to the new building, which by then will be supplied with heat, steam and air conditioning from the power plant. The teaching hospital will open in 1975.

The entire complex is planned and organized to function as a single integrated health sciences facility with the main buildings inter-connected at every level. The basic and clinical science building is designed as an

open-ended rectangle with basic sciences, clinical sciences and student laboratories each occupying a separate wing. The library section of the building occupies the center court created by the other three wings. At each level departmental offices and laboratories in the clinical science wing will correspond, as nearly as possible, to the clinical service located on that floor of the hospital building.

The School is planned for classes of 100 medical students each, with additional provision for graduate students who are candidates for M.S. or Ph.D. degrees in the basic medical sciences. The teaching hospital includes facilities to be used by other allied health professions.

Features of the basic and clinical science building of particular interest to students include: three lecture halls one above the other, each with 175 seats and full audio-visual support; entry to each lecture hall from two floors, enabling hospitalized patients to participate in clinical conferences; student locker rooms, lounges and a book store located in one area of the first floor convenient to the Library; the abundant opportunity for individual study in the numerous carrels of the Library; excellent facilities for small group conferences; audio-visual facilities that permit the production of educational materials as well as the monitoring of educational programs.

The Library

THE LIBRARY HAS been designed to provide the Medical School and the associated biomedical community with convenient access to the world's scientific literature. For this purpose, a substantial collection has been compiled from the former library of the Pittsburg Academy of Medicine, a European medical library, gifts from individuals and estates, and direct acquisitions. In addition, the Worcester District Medical Society is intershelving its holdings with those of the Medical School and is represented on the School's Library Committee by two of its members.

Over 2,000 subscriptions are being received by the Library and virtually all worthwhile English-language books on medically-related topics are purchased as they are published. Non-print formats such as microfilm, microfiche, film, slides, audio-tapes and records are acquired when desirable. The Library was recently designated a Government Depository Library, which means that it can receive at the time of issue all government publications on desired subjects.

It is expected that the new Library building will be occupied during the summer of 1973 and thus will be available for classes starting in September, 1973. The new facilities will have a working capacity of 117,000 bound volumes and will contain seating provisions for 461 people, a figure which includes 300 carrel seats.



Library policy permits the circulation of most books to qualified borrowers, and a photocopy machine is present for the reproduction of desired information. Reserve shelves contain volumes that should not be circulated but need to be kept accessible. Reference services are available and a Medline teletype terminal is being installed to provide an on-line connection with the National Library of Medicine's computerized index of medical literature.

The Library is a member of the Worcester Area Cooperating Libraries through which organization each library's resources are made accessible to the other members. The cooperating institutions include the Worcester Foundation for Experimental Biology, Anna Maria College, Assumption College, Clark University, Holy Cross College, Worcester Polytechnic Institute, Worcester Public Library, Worcester State College and four junior colleges. For items not available locally, the Library can utilize the New England Regional Medical Library Service and request material from the extensive collection of the Francis A. Countway Library of Medicine in Boston and the National Library of Medicine.

Requirements for Admission

SELECTION FOR ADMISSION is based upon careful appraisal of the applicant's overall potential for a career in medicine. Factors considered include motivation, maturity and character as well as academic preparation. A minimum of three years of study at the college level is required and a baccalaureate degree is recommended.

The student planning to study medicine should realize that in order for him to fulfill his role in society an education of considerable breadth is required. In seeking to acquire in college a science background that is adequate preparation for medical school he should not forfeit the opportunity to become acquainted with the history, art, religion and literature that constitute his cultural heritage. On the other hand, the student majoring in the humanities should take enough courses in the physical and biological sciences to establish his ability to deal successfully with this aspect of the study of medicine. There is no single program of college study that can be recommended as the best, or preferred, preparation for medical school; therefore, the course of study followed by each student should reflect his own interests and abilities. Applicants are encouraged to undertake advanced study in some field of special interest, including independent study, if this is possible.

Described below are specific course requirements in four subject areas. It should be kept in mind that they represent the minimal acceptable preparation in each of these fields of study. Keeping the number of required courses small permits students greater latitude in the selection of undergraduate majors and enables those not selecting a science major to qualify for admission. A minimum of required courses is also in keeping with the educational philosophy of the School, as expressed in the description of the curriculum.

Biology—A one-year basic course in general biology or zoology is required. Students interested in additional courses should consider genetics, embryology, cell physiology and comparative anatomy.

Chemistry—One year each of inorganic and organic chemistry is required, including laboratory experience. Students interested in advanced courses should consider biochemistry and physical chemistry.

Physics—A one-year course in general physics is required. A student receiving advanced placement credit for a course taken in secondary school may wish to take an additional college-level course.

English—At least one year of college-level study of English is required. Much of the art of medicine involves competence in communication. The ability to read rapidly and with good comprehension is essential in dealing with the large volume of medical scientific literature; proficiency in writing

clearly and concisely is highly desirable. Therefore, the applicant will be expected to have an adequate command of the English language.

Additional Recommended Courses—Because a knowledge of mathematics becomes increasingly important in the study of science, a course in calculus is recommended. The study of psychology, sociology and social anthropology will provide useful background for understanding human behavior in response to illness. An understanding of statistical methods is helpful in evaluating scientific data and some knowledge of economics is pertinent to study of the socio-economic aspects of medical care.

The prospective medical student is urged to consult the publication of the Association of American Medical Colleges entitled “Medical School Admission Requirements” in which he will find much helpful information concerning medical schools and preparation for the study of medicine. Copies of the book may be purchased from the Association at One Dupont Circle, N.W., Washington, D.C. 20036.

Applications

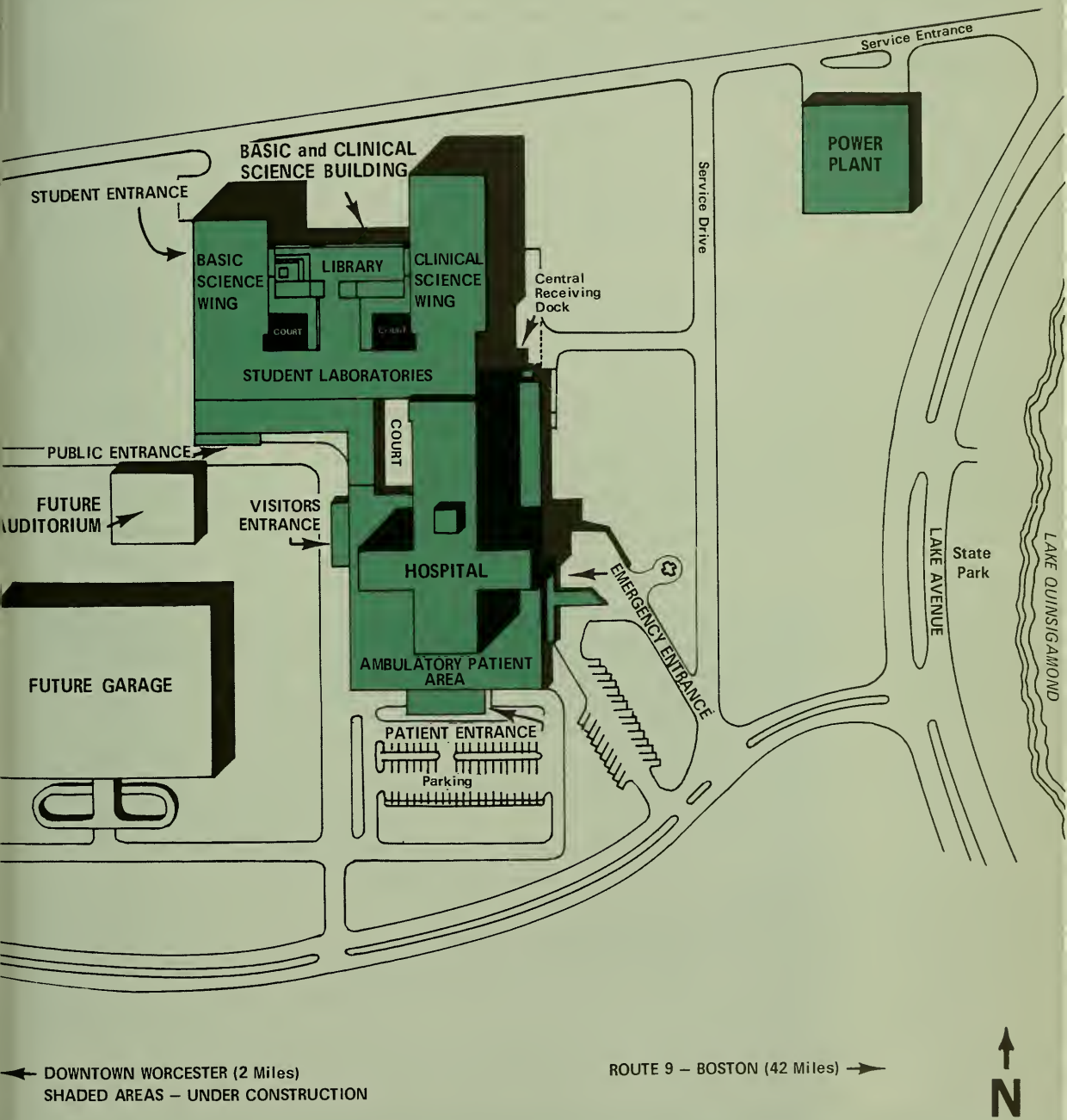
APPLICATION FORMS for admission to the University of Massachusetts Medical School may be obtained by writing to the School’s Office of Admissions, 419 Belmont Street, Worcester, Massachusetts 01604. Applications are accepted between July 1 and December 15 of the year prior to admission. No application fee is required.

All applicants are required to take the Medical College Admissions Test. The test is administered in the spring and fall of each year. Further information may be obtained from The Psychological Corporation, 304 East 45th Street, New York, New York 10017.

Admission Policy and Acceptance Procedures

THE ADMISSIONS COMMITTEE will review all completed applications with supporting documents. Applications will be considered complete when all of the following have been received:

- (a) The completed application form.
- (b) Certified transcripts of applicant’s grades from each college or university attended. Applicants should request the Registrar’s Office to send transcripts directly to the Medical School. Copies of transcripts sent by applicants cannot be accepted. As additional course work is completed, transcripts should be sent as long as application is still active.
- (c) Letter of recommendation. A letter of evaluation that is the official recommendation of the school’s Premedical Advisory Committee will suffice. If such a letter, or form, is not provided by the applicant’s



school, the names and addresses of two instructors to whom the School may write for recommendations must be supplied.

(d) MCAT scores.

(e) A Certificate of Domicile and Residence, properly authenticated by the Clerk of the town or city in which the applicant resides. It is the current policy of the Committee on Admissions to consider only those applicants who are certified as legal residents of the Commonwealth of Massachusetts and citizens of the United States. The policy governing eligibility for in-state tuition is printed on the back of the Certificate of Domicile and Residence provided with the application blank.

Receipt of the application form will be acknowledged promptly. Periodically thereafter, all applicants whose applications are not complete (see above) will be informed as to which documents have not been received. All required documents should be submitted as early as possible.

Completed applications will be reviewed by the Committee on Admissions and personal interviews scheduled if the Committee believes these will be helpful. Interviews will be held at Worcester.

The Committee on Admissions will employ a "rolling" admissions policy. Applicants selected for admission will be so notified and will normally be expected to accept or reject a place in the class within two weeks. In exceptional circumstances, applicants may be granted an additional two weeks in which to make a decision.

When all places in the class entering in September have been filled, remaining applicants will be so notified. However, a list of alternates will be prepared and should any of the enrolled students withdraw prior to the opening of school, replacements will be selected from the list of alternates. Applicants selected as alternates will be informed of this and requested to indicate whether or not they wish to have their names remain on the list.

No deposit is required of those applicants who are offered and accept a place in the entering class. However, anyone who accepts a place and later decides to withdraw will be expected to inform the Office of Admissions immediately in order that another applicant may be accepted.

The application, supporting documents, and all correspondence should be mailed to: Committee on Admissions, University of Massachusetts, Medical School, 419 Belmont Street, Worcester, Massachusetts 01604.

Evaluation of Applicants

THE COMMITTEE ON ADMISSIONS is composed of faculty members representing several different scientific disciplines from the basic and clinical sciences. It is the responsibility of the Committee to recommend applicants to the Dean for acceptance. Every application for admission and all information

provided by, or on behalf of, the applicant is carefully evaluated by the Committee as it endeavors to select those who possess exceptional personal qualifications as well as the intellectual ability and academic preparation necessary for the successful study of medicine. There is no discrimination against any applicant because of race, religious belief, sex, or political affiliation.

Letters of recommendation are required and those from Premedical Advisory Committees, or their equivalent, are preferred. When these are not available, the applicant must provide the Committee with the names and addresses of two or more college instructors who are willing to give the Committee a personal evaluation of the applicant.

The decision to interview certain applicants rests with the Committee on Admissions and the Dean. It is not possible for the Committee to interview all applicants. Those invited for interview are those deemed by the Committee as not only qualified for admission but also likely to be competitive for a place in the class. The interview offers an opportunity for exchange of information between Committee and applicant, and allows the latter to see the School, sense the atmosphere for learning, and to meet and talk with students. For these reasons, all interviews are held at the Medical School except in the instance of students in schools out of state who find the cost or inconvenience of coming to Worcester to be burdensome. For such students, other arrangements will be made upon request.



Transfers

THE SCHOOL WILL accept applications from students wishing to transfer with advanced standing, provided there are vacancies in the class. The same residency requirements must be met as for students entering the first year. Those interested in applying should direct their inquiries to the Office of Admissions.

Expenses and Fees

THE MAJOR EXPENSES not listed below are those for meals, rooms, and customary living expenses. In the absence of University-operated living and dining facilities, the cost of room and board can vary from student to student. It probably is wise to allow \$750 to \$900 for meals and \$600 to \$900 for individual accommodations, per academic year. The cost of apartments for married students is somewhat greater.

Fees and other expenses that can be anticipated are:

<i>Application Fee</i>	(None)
<i>Acceptance Deposit</i>	(None)
<i>Tuition—Massachusetts Residents*</i>	\$600
<i>Microscope Charge**</i>	\$35
<i>Books, Instruments and Supplies including Laboratory Coats (estimated)†</i>	\$250
<i>Student Health Fee††</i>	\$70

*In order to register as a Massachusetts resident, a student must have on file in the Office of Admissions a Certificate of Residence properly authenticated by his Town or City Clerk. Only Massachusetts residents will be accepted for 1973-74.

**A microscope for each student is provided by the School. A charge is made for upkeep and repair of these instruments. Students wishing to purchase their own microscopes may do so, but should consult the Department of Anatomy regarding approved models.

†Average expense for first three years; expenses of the fourth year should be somewhat less.

††Optional medical-surgical insurance is available. The cost of the individual is \$37.50 per year; family coverage is an additional \$36.75 per quarter.

Financial Assistance

THE FACULTY IS AWARE that some students will need financial assistance in the form of scholarships and loans. Possible sources of such funds are constantly being explored and every effort is made to obtain money for both purposes. Applicants who know that they will need financial assistance should so

indicate in the application for admission. This does not diminish the individual's chances of being accepted, and enables the administrative officers to anticipate more accurately the total needs of students. Applicants are also urged to explore private sources of assistance that may be available to them as individuals. In some communities fraternal orders, civic groups, churches, and other organizations offer assistance to medical students.

All applicants who anticipate applying for financial aid from the Medical School should also apply to the Massachusetts Board of Higher Education for a scholarship, if eligible. Application forms and instructions may be obtained at the Financial Aid Office of most colleges in Massachusetts, or by writing to the Scholarship Office, Commonwealth of Massachusetts, Board of Higher Education, 182 Tremont Street, Boston, Mass. 02111. Attention is called to the April 1 deadline for filing applications with the Board of Higher Education and the fact that the applicant need not be accepted into medical school before applying.

Applicants should request that copies of their confidential financial statements be sent to *both* the Board of Higher Education in Boston and to the Medical School in Worcester.

Residents of Worcester County are eligible to apply to the Worcester County Health Association for the Roy J. Ward, M.D., Memorial Scholarship supported by that organization. The scholarship is made possible by voluntary contributions from members of the Association.

Scholarships have also been established by the Worcester District Medical Society and by the Woman's Auxiliary of the Worcester District Medical Society. These are awarded annually. Details of eligibility and the procedure for applying for all scholarships may be obtained at the Office of Admissions.

Monies received by the School from the Massachusetts Medical Society and from the American Medical Association, Education and Research Fund, have been set aside to be used for scholarships and loans. Application is made annually by the School for scholarship and loan funds from federal sources. The amount of money that may become available cannot be anticipated prior to actual notification of funding. Application for loans from these funds is made directly to the Medical School. Distribution of funds will be made on the basis of financial need.

All applications for financial assistance will be evaluated by the Financial Aid Committee and awards are made on the basis of relative financial need. Although the Committee will act on applications as soon as possible each year, it may be late summer before the Committee has adequate information as to the monies available for distribution.

Student Facilities

LOCATED ON THE FIRST floor of the Shaw Building is a large multipurpose room where students, faculty, and staff may meet informally. Its facilities include vending machines, tables at which snacks and lunch may be eaten, and lounging area. The room is convenient to both the Library and laboratories and supplements the Library reading area. Library and laboratories are open at night for use by students.

Each student will be assigned a personal locker in the laboratory area.

Opportunities for outdoor recreation are abundant. Facilities for boating, fishing and swimming are available at Regatta Point, immediately across the street. Quinsigamond State Park, containing tennis courts, athletic fields, and a state-operated indoor ice-skating rink is just a short walk south of the School. Mount Wachusett with its skiing facilities is about 30 minutes away by automobile. Golf courses open to the public are located nearby.

Housing and Transportation

THE SCHOOL HAS ONLY limited facilities for housing single students and these have been assigned to upperclassmen. The staff, assisted by professional consultants, has canvassed the nearby residential areas to determine what accommodations may be available for rent. In early summer this information will be made available to all students who will then be expected to make their own arrangements with landlords, and with each other, if they wish to share apartments.

Bus transportation to the campus is possible on several different routes. From some locations, however, students may find it desirable to commute by private automobile. Those who wish to park at the Shaw Building are requested to obtain a parking permit at the Registrar's office.

Meals

STUDENTS WISHING TO bring their own lunches can supplement these with foods and beverages from vending machines in the lounge area. Restaurants are located in the general vicinity of the School, although some of these are best reached by automobile in inclement weather.

Student Health

PRIOR TO THE OPENING of school each year, students will be informed of details of the plan for health supervision and the options available to them for obtaining medical-surgical insurance at the lowest possible rates.



The Curriculum

THE YEARS OF STUDY in medical school are looked upon as the middle period in a continuum of formal education that begins with entry into college and extends through the years of graduate study and specialty training. During these early years, the student must cultivate those attitudes and habits that will enable him, as a physician, to keep his knowledge current throughout his career. In an era of rapidly expanding information relevant to the sciences basic to medicine, the burden of keeping informed falls squarely upon the individual physician and his success at this depends upon mastering the process of sustained self-education. It is sobering to realize that appropriate methods of diagnosis and treatment are, to a substantial degree, replaced by more effective methods in every decade.

Because of the need to acquire the tools of self-education, a significant portion of the curriculum for each student at the University of Massachusetts Medical School will be planned and implemented by the student himself. The faculty will offer guidance in making these plans and supervision will be provided to whatever extent is necessary. At the same time it is recognized that there is a body of information that is fundamental to an understanding of health and disease and is applicable to almost all areas of medical practice. Some courses will, therefore, be required of all students. Thus, the curriculum is designed to provide a sound basis for proceeding into any of the many careers open to physicians and each student will be offered the opportunity to select particular areas of medical science for study in depth. Periods of elective time for this purpose are provided in the schedule.

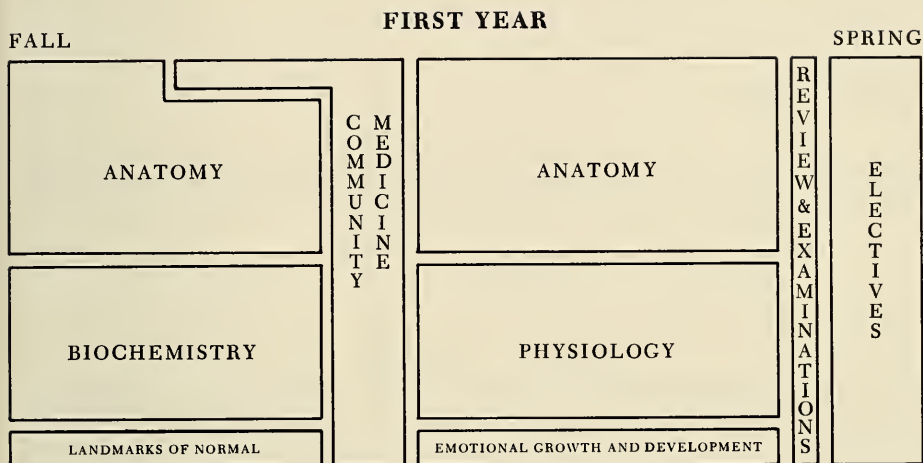
It is considered essential that the plan of study also contain free, unscheduled time which each student is expected to utilize to his own benefit. Laboratories and the Library will be available to him during this time, as will nearby facilities for recreation.

Plan of Study (All Departments)

Orientation Period

THE ACTIVITIES OF THE first day will include registration followed by orientation sessions designed to provide an opportunity for students to meet the faculty and to discuss the curriculum. It is important that entering students have a clear understanding of the educational philosophy on which the curriculum rests and of the goals toward which it is oriented. The small size of the School during these early years makes possible the development of a sense of mutual respect and understanding between students and faculty that hopefully begins the very first day.

First Year

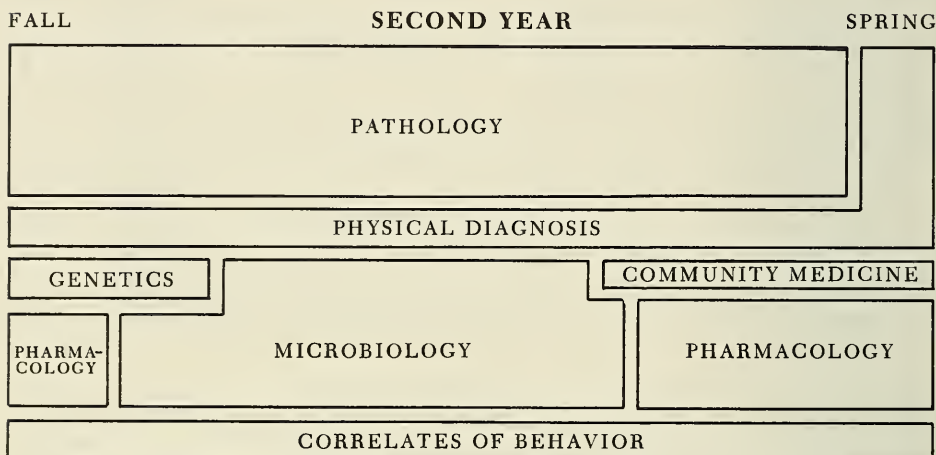


THE BULK OF THE FIRST year is devoted to the study of normal structure and function of cells, tissues and organs. Two and one-half days a week for the first 13 weeks are devoted to anatomy, and two to biochemistry. A series of lectures and discussions dealing with fundamental aspects of personality development is begun by the staff in psychiatry. During the last six weeks of this block of time the Department of Community Medicine considers various aspects of the delivery of health care. These latter sessions serve as background for, and introduction to, a three-week field project in Community Medicine immediately following the Christmas recess. For the next 15 weeks anatomy is presented in conjunction with physiology; during this block of time one half-day per week is devoted to an interdisciplinary consideration of topics related to clinical problems. The participating faculty are from both basic and clinical sciences but the topics selected correlate closely with the material being studied in physiology.

Following a week of review and examination, the final four weeks of the spring term are reserved for special projects. This time has been made available to provide each student with an opportunity to pursue a concentrated study in depth of some topic within his area of particular interest. In the spirit of preparing students to continue their own education after their years of formal training, this important portion of the first-year program is designed to allow the individual student to come to grips with a particular problem and—with the guidance of a faculty member—to devote his full energies toward its resolution. The time may be devoted to library projects, laboratory projects, or field projects in Community Medicine. Regardless of the nature of the subject of this endeavor, each student will gain first-hand

experience in the acquisition and evaluation of data. It is anticipated that some funds will be available to provide stipends for a few students who may wish to continue their projects through the summer months.

Second Year



DURING THE SECOND year emphasis is placed on physical abnormalities, pathological processes and the development of diseased states. An attempt is made to correlate the subject matter in the courses being taught simultaneously. Pathology is taught two days a week throughout most of the year. After an introduction to some of the basic principles of pharmacologic action of drugs, microbiology is introduced in the fall and continues concomitantly with pathology until the end of February when the teaching of pharmacology resumes. A brief course in genetics is offered in the early fall. Psychiatry and physical diagnosis are assigned time each week throughout the year. The former deals with various aspects of human behavior and psychoanalytical theory while the course in physical diagnosis introduces the student to clinical medicine. Emphasis is on the doctor-patient relationship and on acquiring skill in obtaining the medical history and performing the physical examination. Teaching is done at the several hospitals in Worcester, much of it at the bedside. During the spring, epidemiology of disease is taken up by the Department of Community Medicine.

Third and Fourth Years

THIRD AND FOURTH YEARS

MEDICINE*	SURGERY*	PEDI- ATRICS °	OBSTE- TRICS AND GYNE- COLOGY °	PSY- CHI- ATRY °	COM- MUN- ITY MEDI- CINE °	ELECTIVES
12 WEEKS	12 WEEKS	6 WEEKS	6 WEEKS	6 WEEKS	6 WEEKS	6 MONTHS

* The sequence of clinical clerkships is varied.

THE LAST TWO YEARS of the curriculum are planned as a unit beginning with a series of clinical clerkships and includes a series of basic science and/or clinical electives. In the third year the class is divided into small groups of approximately four students. Each group is assigned to a clinical service at an affiliated hospital where it participates in the day-to-day care of patients as part of a team whose other members include interns, residents and attending physicians. Instruction in such fields as radiology, anesthesiology and the sub-specialties of medicine and surgery takes place in conjunction with other in-hospital activities. The total clinical experience in most fields includes the care of both hospitalized and ambulatory patients. The continuing program in Community Medicine includes the opportunity to work with practicing physicians in various communities and students come to know the role of the family physician and his relationship to other specialists. Such assignments offer each student the opportunity to make an initial appraisal of the health needs of society and to decide how he can best contribute to meeting those needs.

During the final six months of the curriculum, each student is expected to select for intensive study a field that holds special interest for him. With the guidance and counseling of members of the faculty, he plans a balanced program of study, combining work in both basic science and clinical departments, as appropriate to his particular field of interest. The possibilities for elective work include an extended clinical experience in hospital and clinic, work in a clinical or basic science laboratory, library research, preceptorial association with a physician in private practice, work with a Department of Health or community health agency, or study at another

medical center. It is the intent of the faculty to allow each student considerable latitude in planning his elective activities, but in each instance it is necessary to obtain faculty approval for the program of study proposed. Those responsible for the supervision of each student submit reports on the nature and quality of the work performed.

Grading System

THE FACULTY BELIEVES that some system of periodic evaluation is essential to enable students to identify their deficiencies and misconceptions and to permit instructors to evaluate their teaching efforts. Through frequent and intimate contact with students, the faculty will seek to identify early any difficulty a student may be having in understanding a topic and will advise him regarding such problems, for it is the intent of the faculty that all students admitted to the School shall successfully complete their course of study.

The School's philosophy of emphasizing learning as the result of personal initiative is reflected in its pass-fail system of grading. The faculty offered students the option of receiving an "honors" grade but this was categorically rejected by the first class. Grades are based upon personal observation of student performance in laboratory, in conference and in work with patients, as well as upon performance on written examinations.

After careful consideration, it has been decided not to require students to take the examinations of the National Board of Medical Examiners, although it is anticipated that most students will elect this method of examination for purposes of subsequent licensure.

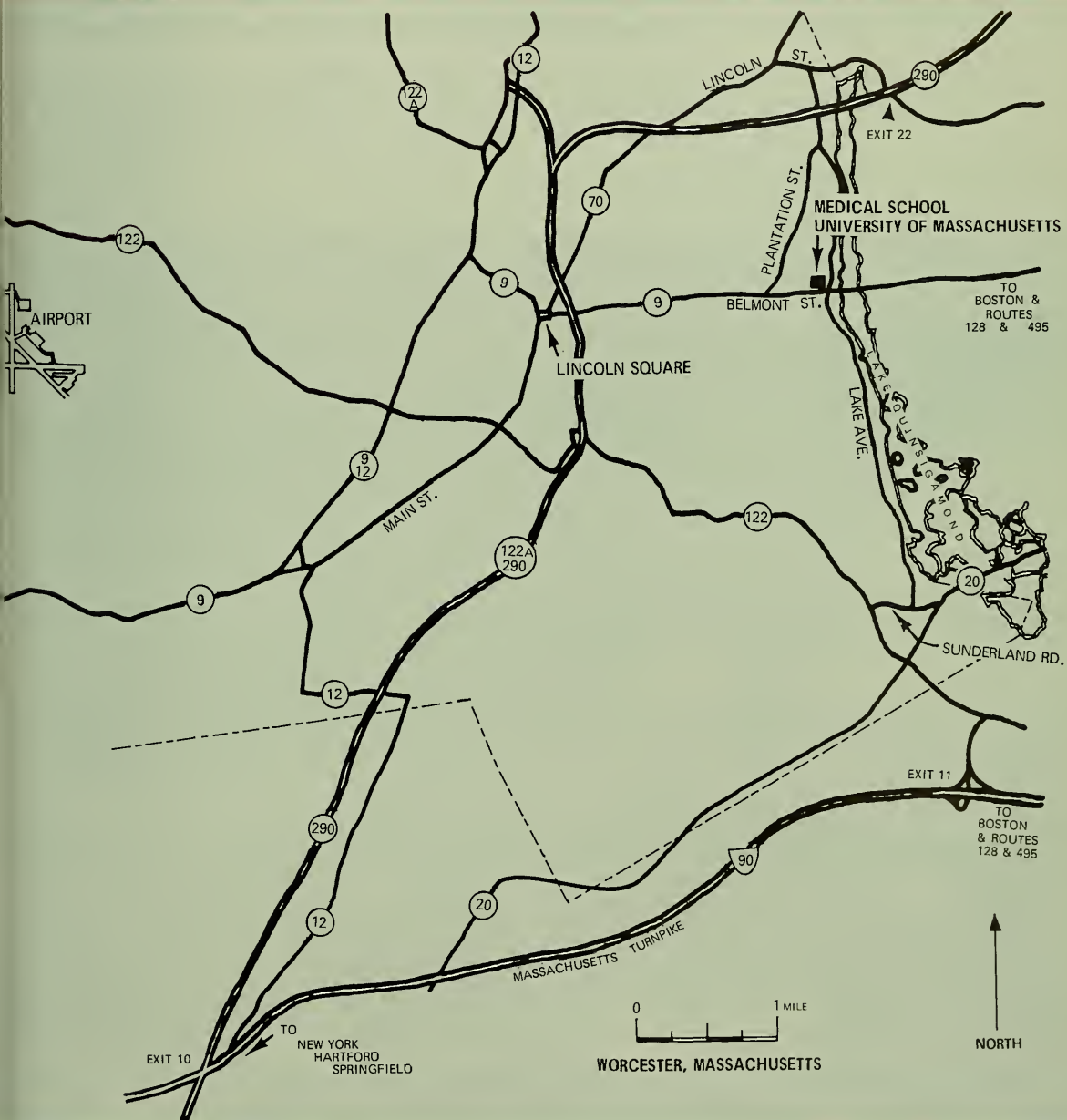
Promotion and Graduation

PROMOTION FROM ONE PHASE of the curriculum to the next is determined by the Committee on Promotions, consisting of instructors from each department involved in the curriculum of a given period of study. In the event of unsatisfactory work in a course the Committee, on recommendation from the department concerned, determines the course of action that a student must follow to complete the work satisfactorily. Students whose performance indicates that they give little promise of succeeding in medicine will be requested to withdraw.

A student may withdraw voluntarily from the School upon written application to the Dean. Application for reinstatement must be received in writing at least two months prior to the date of readmission and for favorable action must be approved by the Committee on Admissions.

Upon satisfactory completion of four years of study of not less than 32 weeks

each, as a regularly matriculated medical student, and having fulfilled all other requirements of the University, each student will be recommended by the Dean to the President and Trustees of the University of Massachusetts for the degree of Doctor of Medicine.



Areas of Study

Department of Anatomy

Department of Biochemistry

Department of Community Medicine

Department of Medicine

Department of Microbiology

Department of Obstetrics and Gynecology

Department of Pathology

Department of Pediatrics

Department of Physiology

Department of Psychiatry

Division of Surgery

Department of Orthopedics

Course in Pharmacology



Department of Anatomy

Professor and Chairman—S. L. Clark, Jr.

Professor—M. K. Wolf

Assistant Professors—F. J. Chlapowski and S. C. Marks

THE DEPARTMENT OF ANATOMY, dealing with basic medical science, approaches biological problems from the structural point of view, in terms of development and function. A knowledge of structure provides the conceptual framework within which all development and function—normal and abnormal, healthy or diseased—must be understood. Living things consist of highly compartmentalized systems—organs, cells, organelles—in which biochemical events are quite different from those found in homogenates of tissues studied in the test tube. Continuing life is possible only because the elaborate structures of cells and tissues provide compartments in which mutually antagonistic but necessary chemical reactions can be kept separate.

Anatomy, the oldest of the medical sciences, deals with structure from the gross to the submicroscopic; the electron microscope and other anatomical instruments allow the structure of large molecules to be seen, thus bridging the gap between anatomy and biochemistry. Because of his broad-ranging interest in structure, the true anatomist is not satisfied with dissecting a system to understand the nature of its smallest components; he also works to understand how complex systems of cells, organs, individual organisms and even whole societies function. He is willing to accept the difficulties and uncertainties of working with complex systems because he is aware that they function in ways that cannot be predicted wholly from a knowledge of all their independent components.

Students in anatomy are, for a while, anatomists. They study structure as anatomists do: always in terms of development and function, and using the tools of anatomists—hands, eyes, microscopes, electron microscopes and the published work of other students of anatomy. Although the beginning student does not have time to become expert in using the electron microscope, he can examine the raw data—electron micrographs—just as anatomists do, gaining his own anatomical knowledge by first-hand experience. There are opportunities, for those interested, to spend additional time becoming more expert at solving anatomical problems independently. During the later years of the medical curriculum, there is opportunity to return to anatomy to learn the specialized anatomy of one's particular field of interest in medicine.

Department of Biochemistry

Professor and Chairman—R. W. Butcher

Associate Professor—I. D. K. Halkerston

Assistant Professors—R. B. Clark, K. J. Hittelman

Research Professor—M. B. Hoagland

Associate Research Professor—F. Welsch

AS BIOCHEMISTRY BECOMES increasingly important to the physician as a tool both for understanding normal and disease states and for rationalizing therapeutic intervention in disease, it necessarily becomes increasingly important that the physician have a firm understanding of the molecular mechanisms by which cells carry out and control their various functions. An appreciation of these biochemical processes is fundamental to an understanding of contemporary medicine and, perhaps more importantly, to medicine in the future.

The vast amount of detail which presently comprises the discipline of biochemistry precludes comprehensive coverage in a medical biochemistry course and, indeed, such an approach may not even be desirable. Therefore, stress is placed on the understanding of biochemical theory and principles, and rote memorization is discouraged. The syntheses and transformations of biochemical compounds by cells—with emphasis on structure-function relationships and control mechanisms—are presented in lectures augmented by informal conferences. Problem sets, which stress deductive reasoning in the application of biochemical principles, are used to illustrate both qualitative and quantitative aspects of biochemistry. The conferences provide opportunities for discussion, extension or clarification of lecture and problem set material. In addition, patients illustrating the clinical manifestations of selected biochemical defects are presented. A limited number of laboratory exercises, designed to illustrate both biochemical principles and capabilities and limitations of current biochemical technology, accompany the course.

Department of Community Medicine

Professor and Chairman—H. S. Fulmer

Professor—G. A. Saxton

Assistant Professors—W. M. Burke, R. F. Walton

Lecturer—J. H. Warram, Jr.

THE DEPARTMENT OF COMMUNITY MEDICINE, concerned with the identification and solution of community health problems, has broad teaching, research and service responsibilities.

In the education of medical students, a prime objective is the development of a perspective on the responsibility of the future physician for his community, along with the traditional responsibility for his individual patients.

To attain such understanding, a certain body of knowledge, together with appropriate skills and attitudes, is of critical importance. The key learning situation is provided in study of the community as "a patient." By actually living and working in communities throughout Massachusetts, the student reviews the existing health status and health services and makes recommendations based on his study. Working directly with faculty, with practicing physicians, with other health workers in the community, and with other students, he learns to identify and quantify the current major health problems, health needs, current changes, and what responsibility he and others might have in guiding such change. He learns about the health needs of the consumers (as individuals and families), and the roles and functions of the providers of medical care. How medical care is and might be organized, financed and delivered is emphasized. In the process, the student learns about the private practice of medicine, the health department and other public agencies, the hospital, nursing home, the voluntary health agencies, experimental health care delivery systems, and the role of all existing and proposed varieties of health manpower. He has the opportunity to work in "team" situations with students in the other health and service professions. By disciplined exposure to health needs, manpower and services, he becomes specifically informed about the health status of the communities of Massachusetts and generally knowledgeable about medicine outside the university hospital.

In the first year, following a short introductory course, a three-week clerkship in the community is provided, during which the student studies consumers and providers of health services. In the second year the principles of epidemiology and medical care are taught and discussed in the classroom, utilizing the experiences of the students during their first-year clerkship for some of the subject material. During a six-week field assignment in the clinical years, each student is expected to conduct a health study of an entire community, to apply the scientific approach to the study of a particular disease problem in the community, and to learn about health problems of individuals and families in the context of the community. Electives are offered during the school year and in the summer. In addition, during the fourth year, electives will be available in communities elsewhere in the United States and in the developing countries.

Department of Medicine

Professor and Chairman—R. B. Hickler

Professor—J. J. Calabro

Research Professor—E. Rosenberg

Associate Professors—M. Farmelant, S. Malkiel, L. Pechet, R. H. Saunders, Jr., E. B. Weiss

Assistant Professors—C. A. Birbara, A. C. Brewster, B. R. Brown, F. X. Dufault, L. M. Edelstein, R. B. Endriga, K. Farbman, N. Higano, E. Landau, J. A. Merritt, Jr., L. J. Morse, S. F. Murphy, P. G. Pletka, J. M. Seidman, L. M. Snyder, O. E. Starobin

Associates—J. Albert, R. K. Anand, P. Aney, R. E. Bessette, W. T. Carleton, H. H. MacGilpen, Jr., R. E. Meyer, H. E. Rubin, G. Spanknebel, I. N. Wolfson

Instructors—K. Hasija, M. J. Lipson, P. S. Schwartz, A. Shuster, J. B. Singh, R. F. Williams

Lecturers—E. Budnitz, R. W. Robinson

THE DEPARTMENT OF MEDICINE contributes to student education during each of the school years. In all years the purpose is to help the student to organize basic information within a clinical context. It is emphasized that the physician combines the intellectual exercise of thinking of disease as a pathophysiological event with a concerned understanding of the impact of illness on a fellow human being.

During the first year, as part of the course in Physiology, the clinical faculty gives a series of conferences that frequently involve the presentation of carefully selected patients. These sessions are designed to define the pathophysiology of specific clinical disorders of each of the major organ systems.

The course in medicine during the second year has several components. One-half day per week is set aside for physical diagnosis and the class is divided among the several affiliated hospitals. During the fall term a series of exercises focuses on the various parts of the physical examination. For the remainder of the year, students are assigned in pairs to a clinical instructor who supervises their history taking and physical examination on assigned patients. On alternate weeks, each student reviews in detail his written record of the medical history and physical findings on the patient seen the previous week. During the second half of the year weekly lectures are given to the assembled class by specialists who describe the clinical approach to patients presenting major symptom complexes, such as dyspnea, edema and anemia.

The clinical clerkship in medicine is conducted during 12 consecutive weeks, in the third year. Groups of students are assigned to the medical services at the affiliated hospitals where each works as an integral part of

the ward team, participating in all activities of the medical department of the hospital. Each student evaluates two to three new patients per week and is assigned to a preceptor with whom he reviews, discusses and analyzes his clinical work on a regular basis. Each hospital provides at its discretion additional student instruction in specialized areas—*e.g.*, pulmonary laboratory, cardiac catheterization laboratory, electrocardiography, and the emergency room. During the medical clerkship instruction is also provided in three additional areas: radiology (12 hours), neurology (8 hours), and dermatology (4 hours).

The last six months of the fourth year are available for elective courses. Ample opportunity will be afforded the student for a concentrated experience in the various laboratory-based clinical sub-specialties in medicine at the several affiliated hospitals, or at other medical centers.

Department of Microbiology

Professor and Chairman—D. J. Tipper

Assistant Professors—K. Farbman, T. J. Leighton, R. L. Taber, Jr.

Instructor—L. B. Weiner

Lecturer—H. L. Ozer

THE DEPARTMENT OF MICROBIOLOGY provides the medical student a basic understanding of the physiology of microorganisms (bacteria, fungi, viruses), and of the response of the human organism to these microorganisms. Bacteria are the simplest, and in evolutionary terms, the oldest organisms on earth, and evolution of differentiated multicellular organisms has required a simultaneous development of effective mechanisms for protection against these potential parasites. In turn, these parasites have continuously evolved to fit the ecological niche provided by the relatively protected milieu which is the host tissues. Host and parasites co-exist in a state of dynamic equilibrium. A section on the fundamentals of immunology starts the course.

Progress in the treatment of infectious disease has revolutionized the practice of medicine over the past 30 years and represents a pinnacle of success in the art and science of medicine. However, the interaction of host, pathogens and antibiotics is constantly changing, and optimal treatment is constantly evolving: a battle is continuously fought to maintain possession of that pinnacle. Application of this knowledge requires rapid and accurate diagnosis of disease and a proper knowledge of the basic mechanisms of action of antibiotics and of resistance to these agents. The student must learn how to use the literature, how to use the clinical laboratory properly, and how to evaluate the claims of the pharmaceutical manufacturers regarding new antibiotic agents.

The main segment of the course covers the pathogenic bacteria and viruses and the treatment of bacterial disease. Small group discussions and clinical correlation conferences supplement the formal lectures. Laboratory exercises and demonstrations are designed to illustrate diagnostic techniques. The course ends with segments on fungal disease and parasitology.

Department of Obstetrics and Gynecology

Professor and Chairman Pro-tem—S. J. Zwirek

THE DEPARTMENT OF OBSTETRICS AND GYNECOLOGY has as its goal to provide the student with a variety of educational experiences which will better prepare him to deal with those conditions peculiar to women and to understand how the altered physiological state complicates other medical, surgical or mental illnesses.

Rapidly changing social values, new concepts in reproductive biology, a better understanding of the pathogenesis of disease, increasing perfection of technical skills, and more sophisticated therapeutic agents and modalities have all had a profound impact on obstetrics and gynecology and are producing significant changes in this specialty. To some extent these changes are reflected in the curricular time devoted to this specialty in medical school. In some medical schools, the study of obstetrics and gynecology has become entirely elective and students may miss the opportunity to become familiar with the physiological processes and diseases peculiar to women. The establishment of a new school provides the opportunity for a fresh approach to the teaching of this important specialty.

The major clinical experience is a six-week rotation at the Wesson Women's Hospital in Springfield, Massachusetts. This specialty hospital providing obstetric, gynecologic and neo-natal care to women and new-borns of the Springfield area is one of the busiest obstetrical-gynecological services in New England with over 5,000 deliveries and 1,800 major gynecologic procedures yearly. Here, the student has access to the full range of obstetrical and gynecological problems as well as to out-patient facilities in the hospital and at two satellite locations within the city. A successful family planning program funded by the Department of Health, Education and Welfare is in its second year of operation.

In the obstetrical clinics, the student becomes adept at taking the medical history and carrying out the physical examination of the obstetrical patient. Pre-natal care is stressed as a dynamic process for the maintenance of the health of both mother and fetus, and for the early detection and correction of complications. Students have the opportunity to acquire considerable experience in the conduct of normal and abnormal labor, carry out a suitable number of deliveries and, in addition, observe and assist at some of

the more complicated procedures such as fetal monitoring, amniocentesis, intrauterine transfusion, cesarean section, etc.

On the gynecology service students are assigned to both ambulatory and hospitalized patients. Full-time faculty, residents and voluntary staff participate in the supervision and instruction of students in both formal and informal exercises in a variety of clinical settings.

In the fourth year students may elect additional training in specific areas of obstetrics and gynecology. Some of these provide opportunity for the student to function at the level of an intern within the hospital and clinic while others can be designed to permit work with individual private physicians. Included in the elective offerings are opportunities to become thoroughly familiar with technical procedures of special interest to students of obstetrics and gynecology.

Department of Pathology

Professor and Chairman—R. A. MacDonald

Professor—G. H. Friedell

Visiting Professors—P. E. Boyle (Oral Pathology), H. E. MacMahon

Associate Professors—S. Castro, G. S. Pechet, L. Pechet

Assistant Professors—E. De Girolami, L. M. Edelstein, J. M. Gibson, R. S. Harper, L. P. James, Jr., S. F. Murphy (Neuropathology), J. Ruggieri, Jr.

Associates—W. J. Blake, G. B. Robbins

Instructors—R. W. Bain, M. Barbarich, W. F. MacGillivray

Research Associate—P. F. Molinari

Lecturers—W. A. Bardawil, C. J. DeWan, L. S. Gottlieb, A. T. Hertig, E. P. Richardson, Jr. (Neuropathology), S. L. Robbins, L. M. Snyder

THE PATHOLOGY DEPARTMENT shares with others the general aims of teaching students to solve medical problems through systematic thinking and reasoning, and preparation for a lifetime of self-learning which is necessary for continued competence in medicine.

The specific aims of pathology are to provide the student with an acquaintance with: the major diseases and their structural changes; the principal etiologic agents of disease and the mechanisms by which they produce altered structure and function; the chief mechanisms of resistance and repair of cells and organs; the role of laboratories in the prevention, diagnosis, and treatment of disease; the role of pathologists in maintaining standards of medical practice; experience in locating and using published resources; and a basic vocabulary of disease.

These aims are achieved through the use of lectures and illustrative material to provide perspective and guidelines for individual study; problem solving

by the student with faculty guidance using actual cases of human disease; self-learning under faculty guidance; seminars and discussions; participation in patient care and diagnosis with pathologists in hospitals; and electives to study selected areas in depth.

The course is presented in four sections: 40% is study of the principal human diseases by organ systems; 25% is basic mechanisms and principles of disease; 10% is clinical pathology in hospitals; and 25% is two elective periods during which the student may work in hospital laboratories, at the medical school, in patient care activities, in research, or in an individual scholarly project.

Department of Pediatrics

Professor and Acting Chairman—J. A. Duggan

Associate Professor—J. Brem

THE PEDIATRIC DEPARTMENT objectives are twofold: to offer the student an appreciation of those physical and functional differences which must be considered by the physician regardless of his field of concentration; and to afford the student a meaningful exposure to infants and children in order to assist him in making a career decision.

During the first year and early months of the second year the unique aspects of infancy, childhood and adolescence are correlated with the student's advancing knowledge of basic science through the clinical correlation conference. During these sessions a physician, aware of the content of the basic science course, presents clinical and lecture material designed to illustrate particular physiologic, pharmacologic and biochemical principles as they affect patient care.

During the latter half of the second year, coordinated with the course in physical diagnosis, a structured series of seminars and clinical demonstrations is presented with emphasis on growth and development, illnesses peculiar to infancy and childhood, and the impact of environmental and social factors on the developing child. Clinical demonstrations are carried out by physicians of the community who are in active pediatric practice. Working with students in teams of two to four, they see patients at hospitals, in out-patient departments and in private offices. Seminar-lectures are presented to groups of eight to ten students.

The clinical clerkships in the third year consist of periods of six weeks during which the student, under supervision, sees patients in the out-patient department, emergency ward, physician's offices, newborn nursery and on the general pediatric ward. During the clerkship, plans are formulated for developing the student's interest in areas in which he wishes to concentrate his fourth-year elective.

Department of Physiology

Professor and Chairman—H. M. Goodman

Professor—T. B. Miller

Assistant Professors—W. J. Cooke, III, F. S. Fay, J. D. Feinblatt, P. Grigg, J. J. Singer, and J. V. Walsh*

THE DEPARTMENT OF PHYSIOLOGY offers instruction designed to provide the student with a working knowledge of the fundamental aspects of physiology and to provide a foundation for an understanding of the functional bases of both health and disease in man. Because continuing advancement in modern medicine rests in large measure upon progress in physiology, the student, and later the physician, must be equipped to keep abreast of new developments in the field. The course work therefore seeks to balance broad coverage of the wide range of physiological subspecialties with in-depth analysis of certain topics that are particularly illustrative of basic principles and methods of analysis. In this way, the student acquires both the factual background and the rational approach to the organization and evaluation of information that are the prerequisites for continuing self-education.

Studies in the Department of Physiology begin with intensive consideration of basic aspects of cellular physiology, with emphasis on the functions of biological membranes. This is followed by an examination of the physiological systems responsible for the regulation of the cellular environment: the cardiovascular, respiratory, renal and gastrointestinal systems. The course concludes with a consideration of the integrative functions of the endocrine and central nervous systems. In addition to formal lectures, throughout the course there are frequent small group conferences, workshops and problem-solving sessions. A few selected laboratory exercises introduce the student to the instruments and techniques available for the study of physiological processes. They also provide graphic illustration of the concepts studied in the lecture hall. The laboratory exercises are supplemented with demonstrations and films.

Department of Psychiatry

Professor and Acting Chairman—E. Mason

THE DEPARTMENT OF PSYCHIATRY makes an effort to help the student understand the forces that mold modern man in his community. The effects of the internal and external environment on the development of the personality are examined and the interaction between psyche and soma is studied. The thread of development is followed from earliest life to the time of the

*Leave of absence, 1972-73.

senium, with emphasis on the periods of change. The effects of emotional and mental malfunction are studied in the laboratories of human behavior, i.e., the community, home, school, job, the medical clinic, and the hospital. Prevention and methods of treatment are also presented to the students.

In the first year, emphasis is on normal emotional growth and development as viewed from the psychiatric, psychological, social, and medical points of view. The student has an opportunity to witness the effect of the normal growth and aging processes and to see the effect of physical illness on the emotional equilibrium of human beings.

In the second year, attention is paid to the anatomical, physiological, and pharmacological correlates of human behavior. A review of psychoanalytical theory is presented and selected studies from psychiatric pioneers are reviewed.

During the third year, students serve as clinical clerks on the psychiatric unit of St. Vincent Hospital and at the Worcester State Hospital. At this time, they are able to observe the pathological processes that take the patient from his home. The psychoses, neuroses and character disorders are studied. Outpatient work is available in the hospitals and community mental health clinics to acquaint students with the problems of ambulatory mental illness and drug abuse.

During the fourth year, the student may choose an elective period in any community mental health facility that excites his interest and where he feels he may learn and be of service.

Division of Surgery

Professor and Chairman—H. B. Wheeler

Professors—J. B. Herrmann, L. Soutter

Assistant Professor—W. H. J. Chang

Department of Orthopedics

Professor and Chairman—A. M. Pappas

THE DIVISION OF SURGERY participates in interdisciplinary teaching in the first two years and offers third-year students a 12-week introductory course in surgical care. The emphasis is on the pathophysiology of surgical patients, rather than on surgical technique. Most of the students' time is spent in two-week rotating clerkships through the major surgical specialties with half-day sessions in subspecialty areas. Emphasis is given to bedside teaching and direct student participation in patient care, rather than didactic exercises. Fourth-year undergraduate courses are elective.

Undergraduate teaching emphasizes those aspects of surgery which are pertinent to all practicing physicians, and not just those engaged in the practice of surgery. Care of critically ill patients, management of trauma, cardiopulmonary resuscitation, and minor surgical emergencies are covered. An effort is also made to familiarize the student with the spectrum of careers in surgery and to indicate which surgical specialties are most needed at the present time. To assist in this objective, each student has the opportunity to select a preceptor in surgery from the voluntary clinical staff of surgeons practicing in the Worcester area.

The orthopedic portion of the curriculum provides an introductory approach to problems of the neuromuscular system. Topics covered include congenital malformations, trauma, infection, metabolic disease and neoplasm. Orthopedics presents the opportunity to integrate aspects of the pre-clinical sciences with pediatrics, medicine and surgery in an interdisciplinary approach to the neuromusculoskeletal system.

Course in Pharmacology

Professor—T. B. Miller

Assistant Professors—W. J. Cooke, III and J. D. Feinblatt

THE COURSE IN PHARMACOLOGY is being taught by the above as an interdepartmental committee for the academic year 1972-73.

The course in pharmacology is usually considered to be a part of the basic science portion of the curriculum but forms a bridge between pre-clinical and clinical studies. Emphasis is given to basic pharmacological principles as they are related to modern therapeutics. After a general introduction, drugs are considered according to a classification by organ system and therapeutic uses. The biochemical and physiological basis of drug actions are considered. Also emphasized are the problems of drug toxicity and side effects. The important sources of information about drugs are discussed and consideration is given to the process by which new drugs are evaluated. Selected laboratory experiences, hospital visits and clinical correlation exercises are offered as illustrations of important topics and principles.

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